ROBERT G. LA POE

Environmental Impact Analysis Process

ENVIRONMENTAL ASSESSMENT

TITAN IV

Space Launch Vehicle Modification
And Operation

VANDENBERG AIR FORCE BASE, CALF.
FEBRUARY 1988

DEPARTMENT OF THE AIR FORCE

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS SPACE DIVISION (AFSC)
LOS ANGELES AIR FORCE STATION, PO BOX 92960
LOS ANGELES, CA 90009-2960

5 FEB 1988

To: Governmental Agencies, Public Officials, Public Groups and Interested Individuals

Attached for thirty (30) days of public and governmental agency notification, in compliance with the National Environmental Policy Act and the regulations of the President's Council on Environmental Quality, is the Finding of No Significant Impact and the Environmental Assessment for the Titan IV Space Launch Vehicle Modification and Operations at Vandenberg Air Force Based, California.

The Finding of No Significant Impact and the Environmental Assessment address the environmental consequences associated with the construction and modifications to Space Launch Complex 4 East (SLC-4E) and associated launch support facilities necessary to process and launch the Titan IV, pre and post Titan IV launch processing and operations, and launching of the Titan IV from SLC-4E from Vandenberg AFB.

The thirty (30) day public and agency notification period begins on February 8, 1988 and continues until March 9, 1988. Copies of the Finding of No Significant Impact and the Environmental Assessment may be obtained by writing to:

Department of the Air Force
Headquarters Space Division/DEV
Attn: Mr. Robert Mason
P.O. Box 92960
Los Angeles, CA 90009-2960

or by calling: Mr. Robert Mason at (213) 643-1409.

Sincerely

WILLIAM E. LEONHARD, JR., Colonel, USAF
Director of Acquisition Civil Engineering

FINAL

ENVIRONMENTAL ASSESSMENT

TITAN IV SPACE LAUNCH VEHICLE

MODIFICATIONS AND LAUNCH

OPERATIONS PROGRAM

VANDENBERG AIR FORCE BASE
CALIFORNIA

FEBRUARY 1988

Prepared For:

DEPARTMENT OF THE AIR FORCE
Headquarters Space Division
Environmental Planning Division
Directorate of Acquisition Civil Engineering
Los Angeles, California

Prepared By:

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PS019

FINDING OF NO SIGNIFICANT IMPACT (FONSI)
TITAN IV SPACE LAUNCH VEHICLE MODIFICATIONS AND LAUNCH OPERATIONS PROGRAM VANDENBERG AIR FORCE BASE, CALIFORNIA

1. PROPOSED ACTION

In support of the Department of Defense (DOD) space program and to provide assured access to space using expendable space launch vehicles, the United States Air Force (USAF), Headquarters Space Division proposes construction and modifications at Space Launch Complex 4 - East (SLC-4E) and associated facilities at Vandenberg Air Force Base (VAFB), California for processing and launching of the Titan IV space booster. This action represents a continuation of the Titan launch program that began in the mid 1960s.

SLC-4 is composed of two separate launch facilities: SLC-4W, which was used until February 1987 for Titan IIIB launches and is being modified for Titan II launches, and SLC-4E, which currently launches Titan 34D vehicles. The Titan 34D vehicle is being phased out and will be replaced by the Titan IV vehicle. A maximum of four Titan IV launches per year is possible. Initial launch capability (ILC) is scheduled for October 1989.

The proposed action consists of vehicle design modifications to accommodate larger payloads, construction of facilities on North and Sout h VAFB, and modifications to processing and support facilities on North and South VAFB. Titan IV components will be manufactured in various parts of the country and transported by plane or rail to VAFB where systems installation, testing, and payload processing will be conducted in preparation for launch.

On North VAFB, a Materials Receipt and Inspection Facility will be constructed to provide component handling and distribution for the Titan IV program. Facility modifications on North VAFB will occur at the Payload Fairing and Processing Facility (Bldg 8337), Vehicle Assembly Building (Bldg 8401), and the Material Support Facility (Bldg 5500). Bldgs 8337 and 8401 are currently used for similar launch processing and will be modified to include new equipment, work areas, and new security fencing. Warehouse space at Bldg 5500 will be used and five modular trailers will be installed at this location to provide office space.

At SLC-4E, a new Mobile Service Tower (MST) Air Conditioning Building will be constructed at SLC-4E in place of the existing building. Modifications to SLC-4E will include: replacement of the MST; modifications to the Umbilical Tower; addition of a stairway from the fuel trailer pad area to the fuel incinerator pad; improvement of an intersection and repair of shoulders along two roads; and addition of a fuel vapor incinerator and concrete tailer pad, propane trailer pads, payload fuel trailer pad, and payload oxidizer trailer pad.

In the SLC-4 area, modifications will include: enlargement of an existing fallback area for use as a temporary construction prefabrication area, improvement of an existing road for use as a temporary construction haul road, reworking of existing road shoulders and burial of overhead utility lines to accommodate transport of prefabricated components, and addition of temporary contractor parking areas. Construction and modification activities in the SLC-4 area will require approximately 30,000 cubic yards of fill material which will be available from a new borrow site at SLC-4E and from the excavation of material for construction of the new MST Air Conditioning Building.

The Titan IV program will also require the modification of the existing Receipt, Inspection and Storage (RIS) Facility (Bldg 945) which is located on South VAFB. Modifications include: increasing its size; extension of paved areas; and addition of a modular office building, parking area, and a gaseous nitrogen trailer pad.

2. SUMMARY OF ENVIRONMENTAL IMPACTS

2.1 Meteorology and Air Quality

Titan IV program will result in a temporary increase in air emissions during construction and a continuation of existing emissions from processing and launch operations. No significant increase in operational emissions over the amount previously generated for Titan 34D operations is expected. Air emissions from process operations will be mitigated by the use of control equipment and by compliance with stipulations in air quality permits submitted by the USAF to the Santa Barbara Air Pollution Control District.

2.2 Geology and Soils

Because the amount of new construction in undisturbed areas is small, no significant impact to geologic resources will occur as a result of the Titan IV program. Potential impacts to geologic resources from erosion will be prevented or mitigated by measures such as revegetation and erosion control treatment.

2.3 Hydrology and Water Quality

Although the Titan IV program will obtain its water supply from an aquifer that is currently experiencing an overdraft, the proportion of water that will be extracted for the program is relatively insignificant in comparison to the amount currently consumed by ongoing programs at VAFB. There will be no impact to groundwater hydrology as a result of the Titan IV program. Impacts to surface water hydrology will be limited to the discharge of 50,000 gallons per launch and are considered insignificant. Potential impacts to groundwater and surface water quality will be mitigated by the adherence to waste discharge requirements specified by the Regional Water Quality Control Board. Such requirements may include testing of deluge water prior to discharge. Therefore, no significant impact to hydrology and water quality will occur.

2.4 Biota

The expansion of construction laydown areas for the Titan IV program will result in the loss of approximately one acre of dune scrub

habitat. Although dune scrub is considered a sensitive habitat and this particular location has not previously been disturbed, this loss is relatively small when compared to the size of this habitat within the project area. This area will be restored after use as a construction laydown area. Other construction or use of areas for the Titan IV program will be limited to areas of previous disturbance. Therefore, no significant impact to local or regional biota will occur from construction or modification activities.

Certain launch trajectories from Titan IV space vehicles will produce sonic booms that may intersect the surface on or near the Channel Islands, which are important breeding grounds for a number of protected species of marine mammals and sea birds. Based on previous studies of the potential sonic boom effects associated with the Space Shuttle launch from VAFB, it is expected that the Titan IV space vehicle will result in a sonic boom of a substantially lower magnitude. This determination is based on the size and shape of the vehicle and the size of its exhaust plume relative to the Shuttle. The lack of documented impacts to marine species during previous launches from VAFB over the past 25 years and the existing noise environment of the Channel Islands contributes to the determination that Titan IV space vehicle launches will not result in any significant impact to any threatened or endangered species of the Channel Islands. To comply with Section 7(c) of the Endangered Species Act, the USAF is preparing a Biological Assessment to detail the lack of impacts to endangered or threatened plant and animal species from the proposed program. Because the Titan IV program is a continuation of existing launch activities and because a maximum of only four launches per year is planned, no significant impacts to biological resources will occur.

2.5 Population

The Titan IV program will not result in any increase in population on VAFB or in the surrounding area and, therefore, will not have a significant impact on the population of the VAFB region.

2.6 Socioeconomics

The Titan IV program will not result in a change to any land use designation or an increase in the need for additional community services and facilities. A temporary increase in traffic may occur during construction, but will have no significant impact. No long-term increase in traffic will occur. No change in the economy is expected. Therefore, the Titan IV program will not have a significant impact on socioeconomics.

2.7 Hazardous Waste

The increase in the amount of hazardous waste generated at VAFB as a result of the Titan IV program will be mitigated by management practices, as stipulated by applicable federal and state regulations. The Titan IV program is being evaluated under the USAF hazardous waste minimization program and measures will be implemented to reduce the production of hazardous wastes where feasible. Therefore, hazardous waste from the Titan IV program will not have a significant impact on the environment.

2.8 Safety

The Titan IV program will not result in an unreasonable or increased risk to the public. Potential impacts to public safety will be prevented by the safety and disaster preparedness plans for the program. Therefore, the Titan IV program will not have a significant impact on public safety.

2.9 Noise

The launch of a Titan IV vehicle will result in temporary and infrequent high noise levels. The magnitude of this effect will be slightly greater than for the previous Titan 34D program, but does not represent a significant impact to the noise environment of VAFB and the surrounding community. Therefore, the Titan IV program will not result in a significant noise impact on the environment.

2.10 Cultural Resources

The Titan IV program will involve some new construction in undisturbed areas. These areas have been evaluated by a qualified

archaeologist and have been found not to impact any known archaeological resources. One area of construction is in close proximity to a known site, therefore archaeological monitoring during earthwork activities will be accomplished. In the unlikely event that any unknown archaeological resources are discovered during construction, activities in the area will cease or be redirected and the USAF will consult with the State Historic Preservation Officer and the National Park Service as required by the National Historic Preservation Act.

2.11 Cumulative Impacts

The Titan IV Space Launch Vehicle program is one of many programs being considered for development in the Santa Barbara County region. Other programs include military-related projects, oil and gas development projects, and urban/industrial development.

The proposed Titan IV program is a replacement of the Titan 34D program which is being phased out. The natural environment is not expected to experience any impact of greater intensity than that of the previous Titan programs. Temporary increases in emissions would occur during the construction phase and a temporary increase in the noise level would occur during launch for a maximum of four times per year. Therefore, the net increase in impacts to the environment is not significant and will not result in any cumulative impact to the environment.

3. FINDINGS

Based upon the above summary, a finding of no significant impact is made. An Environmental Assessment of the proposed action, dated February 1988, is on file at:

U.S. Air Force Headquarters Space Division/DEV
P. O. Box 92960
Los Angeles, California 90009-2960

ATTN: Mr. Robert C. Mason, SD/DEV

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SECTION 1

PROPOSED ACTION AND ALTERNATIVES

In support of the Department of Defense (DOD) space program, the United States Air Force (USAF), Headquarters Space Division proposes to modify Space Launch Complex 4 East (SLC-4E) and associated support facilities at Vandenberg Air Force Base (VAFB), California for processing and launch of Titan IV space boosters. This action would provide DOD with an assured access to space and would be a continuation of the Titan program at VAFB that began in the mid 1960s. Various configurations of Titan vehicles have been launched from SLC-4 over this period. The Titan IV represents the latest modification to the Titan program and is a continuation of the USAF space launch program at VAFB.

VAFB occupies 98,400 acres along the south-central coast of California and is located approximately 140 miles north of Los Angeles (see Figure 1-1). State Highway 246 bisects VAFB into North VAFB and South VAFB. In addition to the Titan program, VAFB is a base of operations for testing of the Minuteman and Peace Keeper (MX) Intercontinental Ballistic Missiles (ICBMs) and space launch activities for the Scout, Delta, Atlas and Space Shuttle space launch vehicle programs. The Vandenberg Space Shuttle Program recently has been placed in a caretaker status until 1991, when preparations for the initial launch of the Space Shuttle from VAFB, scheduled for 1992, will begin.

The Air Force is modifying SLC-4 West and associated support facilities for launching of Titan II space boosters. The actions associated with the Titan II program and required modifications of SLC-4 West were addressed in a separate Environmental Assessment (ES, 1987).

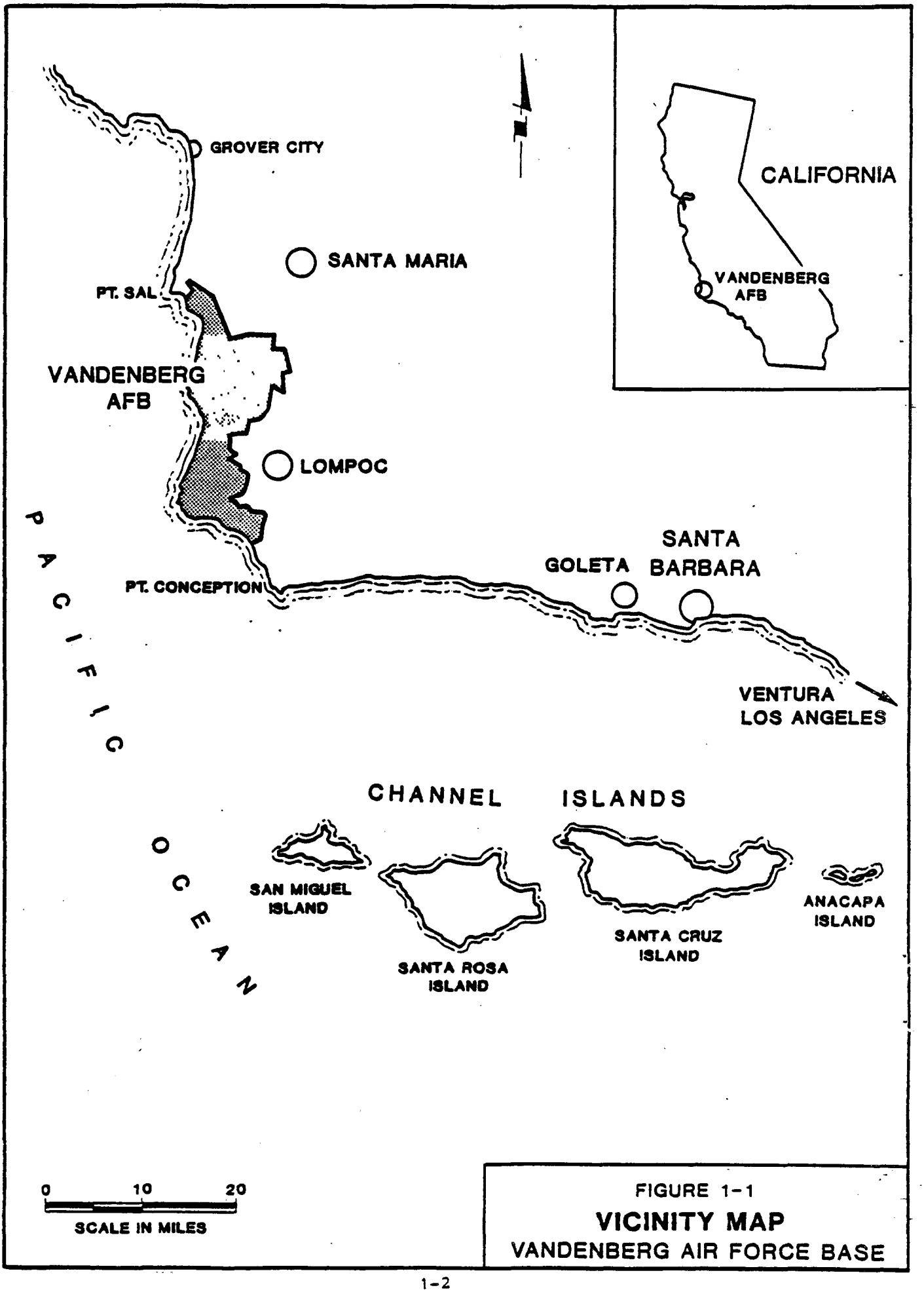


FIGURE 1-1

VICINITY MAP

VANDENBERG AIR FORCE BASE

SLC-4 is located on South VAFB approximately one-half mile inland (east) of the coast, midway between Surf Beach to the north and Point Arguello to the south (See Figure 1-2). Wetlands associated with Spring Canyon are located south of the launch complex. The general vegetation surrounding the facility consists of the stabilized dune/coastal sage scrub community.

VAFB was originally known as the Camp Cooke Army Post before being transferred to the Air Force in 1957. SLC-4, formerly known as the Point Arguello Launch Complex, came under the control of the Air Force in 1962. The southern portion of VAFB, previously assigned to the Navy, was known as the Naval Missile Facility, Point Arguello, before being transferred to the Air Force in 1964.

SLC-4 is composed of two separate launch facilities, SLC-4W (west) and SLC-4E (east), as shown in Figure 1-3. Table 1-1 shows an historical overview of the different types of space vehicles that have been launched from SLC-4. Figure 1-4 shows the configurations of each of these launch vehicles.

The Titan IIIB and Titan 34D space vehicles are being phased out and will be replaced with the Titan II and Titan IV. As shown in Table 1-1, past and present Titan vehicles use similar propellant as will be used for the Titan II and Titan IV vehicles. For the Titan IV vehicle, the oxidizer is nitrogen tetroxide (N_2O_4) and the fuel is Aerozine-50, a mixture of hydrazine (N_2H_4) and unsymmetrical dimethylhydrazine (UDMH) in a 1:1 ratio. A solid polybutadiene acrylic acid acrylonitrile (PBAN)-based propellant is used for the Titan IV seven-segment Solid Rocket Motor (SRM). Titan IV payloads will use N_2O_4, N_2H_4 and monomethyl hydrazine (MMH). Payloads launched by the Titan IIIB used high density acid (HDA), which is a derivative of Inhibited Red Fuming Nitric Acid (IRFNA). Atlas-Agena D vehicles used a combination of liquid oxygen (LOX) and a kerosene-type hydrocarbon fuel known as RP-1. The Agena portion of the vehicle used uninhibited nitric acid (UNA) and UDMH. Additional information on propellants is provided in Section 1.1.1.6, which includes a comparison of propellant quantities for past, present and future vehicles at SLC-4.

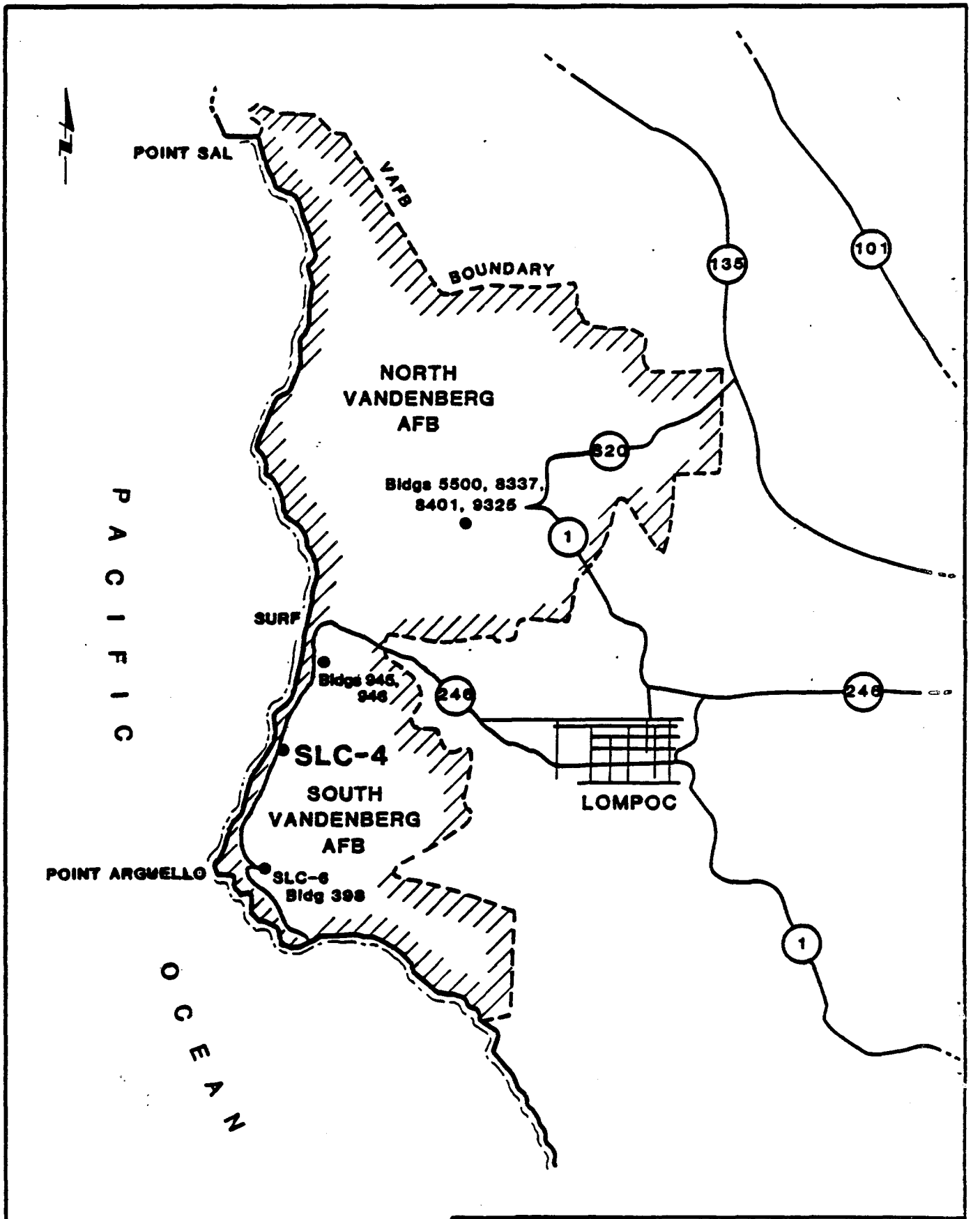
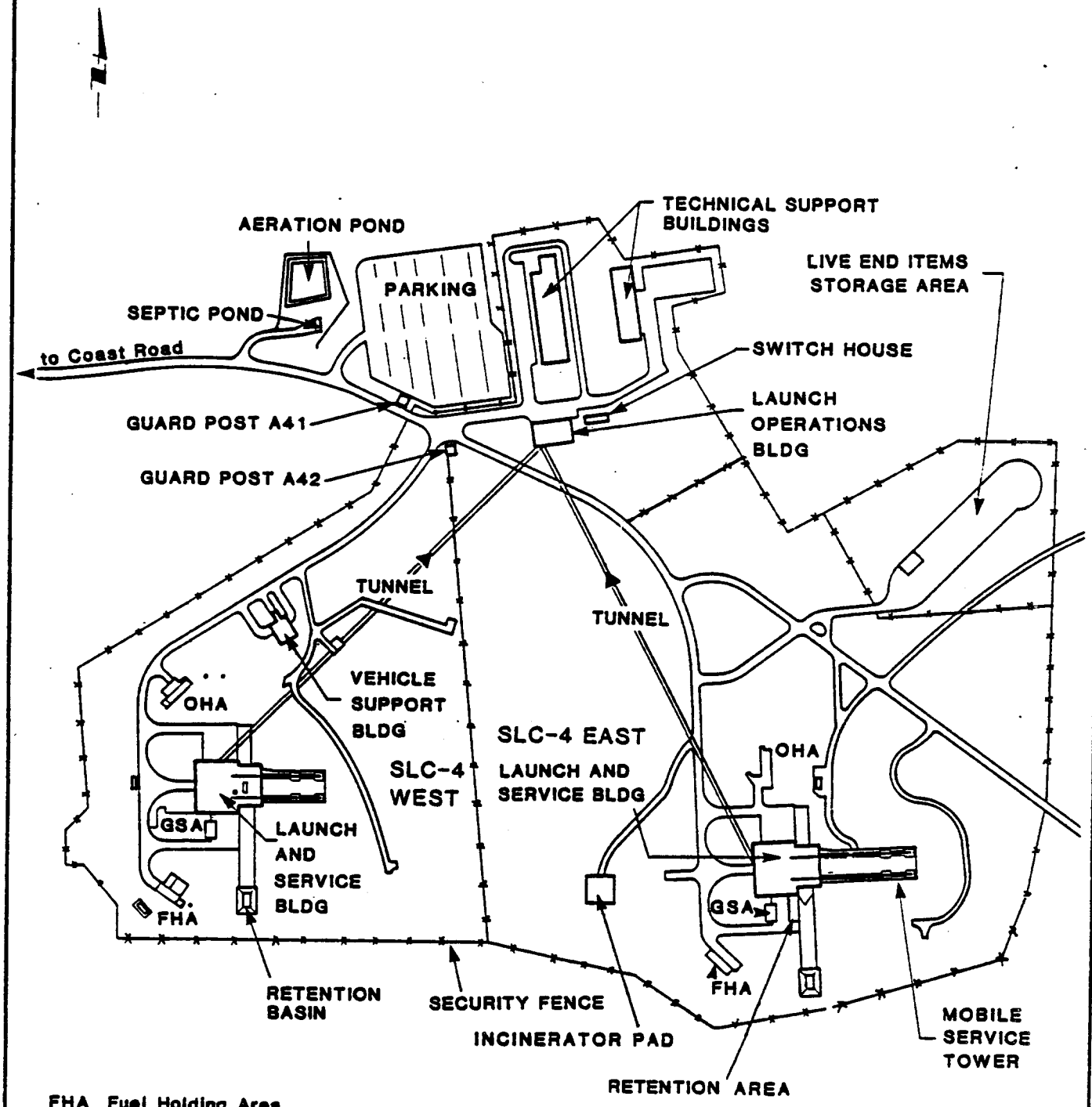


FIGURE 1-2

LOCATION OF TITAN IV PROJECT FACILITIES

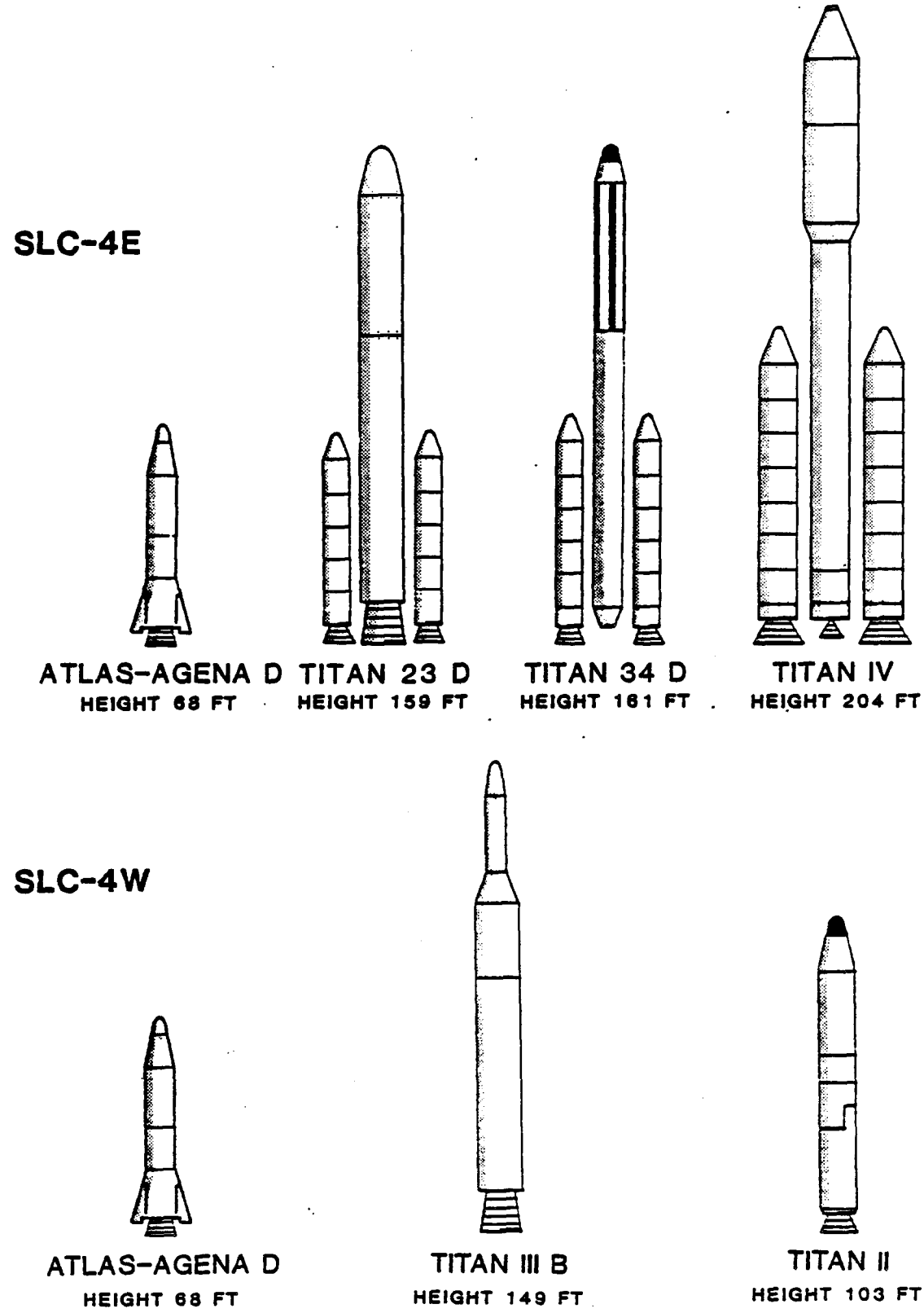
VANDENBERG AIR FORCE BASE



FHA Fuel Holding Area
GSA Gas Storage Area
OHA Oxidizer Holding Area

0 200 500
SCALE IN FEET

FIGURE 1-3
SPACE LAUNCH COMPLEX - 4
VANDENBERG AIR FORCE BASE



Note: Drawings are not to Scale

FIGURE 1-4

SPACE LAUNCH VEHICLES OF SLC-4

VANDENBERG AIR FORCE BASE

TABLE 1-1

HISTORICAL OVERVIEW OF SLC-4

Vehicle	SLC-4E	SLC-4W
Past Vehicles		
Vehicle Type	Atlas-Agena D	Atlas-Agena D
Years Launched	1964-1967	1963-1965
No. of Launches	27	11
Propellant Type[a]	LOX/RP-1/IRFNA/UDMH	LOX/RP-1/IRFNA/UDMH
Vehicle Type	Titan IIID	Titan IIIB
Years Launched	1971-1982	1966-1987
No. of Launches	21	68
Propellant Type[a]	N_2O_4/Aerozine-50/ solids	N_2O_4/Aerozine-50
Present Vehicles		
Vehicle Type	Titan 34D	Titan II
Years Launched	1983-1987	Initial Launch Capability 1988
No. of Launches	6	3 (maximum per year)
Propellant Type[a]	N_2O_4/Aerozine-50/ solids	N_2O_4/Aerozine-50
Most Recent Launch	October 1987	February 1987 (Titan IIIB)
No. of Launches Still Scheduled	1	13

[a] LOX - liquid oxygen
N_2O_4 - nitrogen tetroxide
RP-1 - kerosene-type hydrocarbon fuel
UDMH - unsymmetrical dimethyl hydrazine
IRFNA - Inhibited Red Fuming Nitric Acid

SLC-4W and SLC-4E were recently restored to launch capability after suffering extensive damage as a result of a Titan 34D vehicle failure that occurred in April 1986. Damage to ground support equipment and facilities at SLC-4 and ground fires in the vicinity occurred following the explosion of the Titan vehicle which occurred at an altitude of approximately 800 feet. The restoration included repair/replacement of equipment and facilities to restore the launch complex to its pre-

accident launch capacity. In addition, the restoration includes upgrades that will be utilized by the Titan II and Titan IV programs. The restoration of launch capability at SLC-4 was addressed in a separate Environmental Assessment prepared by the USAF (Versar, 1987).

1.1 PROPOSED ACTION

The USAF proposes to modify SLC-4E on South VAFB and support facilities on North VAFB and South VAFB to accommodate launches of the Titan IV space vehicle. The individual program modifications and launch activities of the Titan IV space vehicle program are discussed in the following sections.

1.1.1 Titan IV Space Launch Vehicle Program

The proposed Titan IV space launch program at SLC-4E is designed to provide assured access to space for DOD Space Shuttle-class payloads. The Titan IV space booster, formerly known as the Titan 34D7 or Complementary Expendable Launch Vehicle (CELV), is a modified and upgraded version of the Titan 34D launch vehicle.

Previously, SLC-4E was used to launch the Titan IIID. The Titan 34D is currently launched from SLC-4E. Both the Titan IIID and the Titan 34D were developed for space launches and have been launched from VAFB since 1967 and 1980, respectively. The last launch of a Titan 34D at SLC-4E occurred in October 1987. Current Titan 34D operations at VAFB are scheduled for completion in mid 1988. The Titan IV construction program is planned to last for approximately 8 months, beginning in March 1988. Initial Launch Capability (ILC) of the Titan IV space vehicle is scheduled for October 1989. A launch rate of two Titan IV launches per year is currently planned. It is possible that this launch rate may increase in the future. Therefore, the analysis presented is based on a maximum launch rate of four Titan IV launches per year.

1.1.1.1 Vehicle Design

The current Titan 34D space launch vehicle has two Solid Rocket Motors (SRM) which consist of five and a half segments of solid propellant and a two stage core booster which uses liquid propellant.

The Titan IV space launch vehicle to be used at VAFB is currently being designed and built by the Martin Marietta Corporation. In order to increase the payload throw weight of the vehicle, the Titan IV will use two seven-segment SRMs for the initial boost phase of the launch, with each rocket having an increased mass output over the Titan 34D SRMs. The rocket engine core vehicle of the Titan IV will accommodate more propellant in both Stages I and II. The Payload Fairing (PLF), a cylindrical encasement for the payload, will be enlarged to provide a greater payload bay capacity. The PLF consists of three sections called "trisectors" which, when joined with the base and nose parts, form the cylindrical payload housing. A Thrust Vector Control (TVC) system, adaptable to program-unique equipment, will be used to orient the Titan vehicle.

1.1.1.2 Logistics Overview

Titan IV stages will be air shipped by military transport planes from Denver, Colorado to VAFB and transported by truck within VAFB. The air shipment of space vehicle components to VAFB is an ongoing activity in support of current space programs. The core vehicle will be tested and prepared for transport to SLC-4E in Bldg 8401.

The PLFs are manufactured in Huntington Beach, California and will be transported by plane from Los Alamitos Naval Air Station, California to VAFB with trisectors unassembled. The PLFs will be transported by truck within VAFB and processed in Bldg 8337 where they will be prepared for transport to SLC-4E.

Titan IV solid rocket motors originate in San Jose, California and will be delivered to South VAFB and transported to the rail spurs on the east side of Bldg 398 by flatbed railcar. From the rail spurs at Bldg 398, SRMs will be trucked to the High Bay of Bldg 398 for storage, trucked to Bldgs 945 and 946 for inspection and x-ray, and trucked to the launch pad or Bldg 398 for storage. The transport of Titan IV components on VAFB is shown in Figure 1-5.

At SLC-4E, the inertial guidance system, batteries, and ordnance items will be installed. Depending on the scheduled launch, the appropriate satellite vehicle and PLF will be mated to the core vehicle.

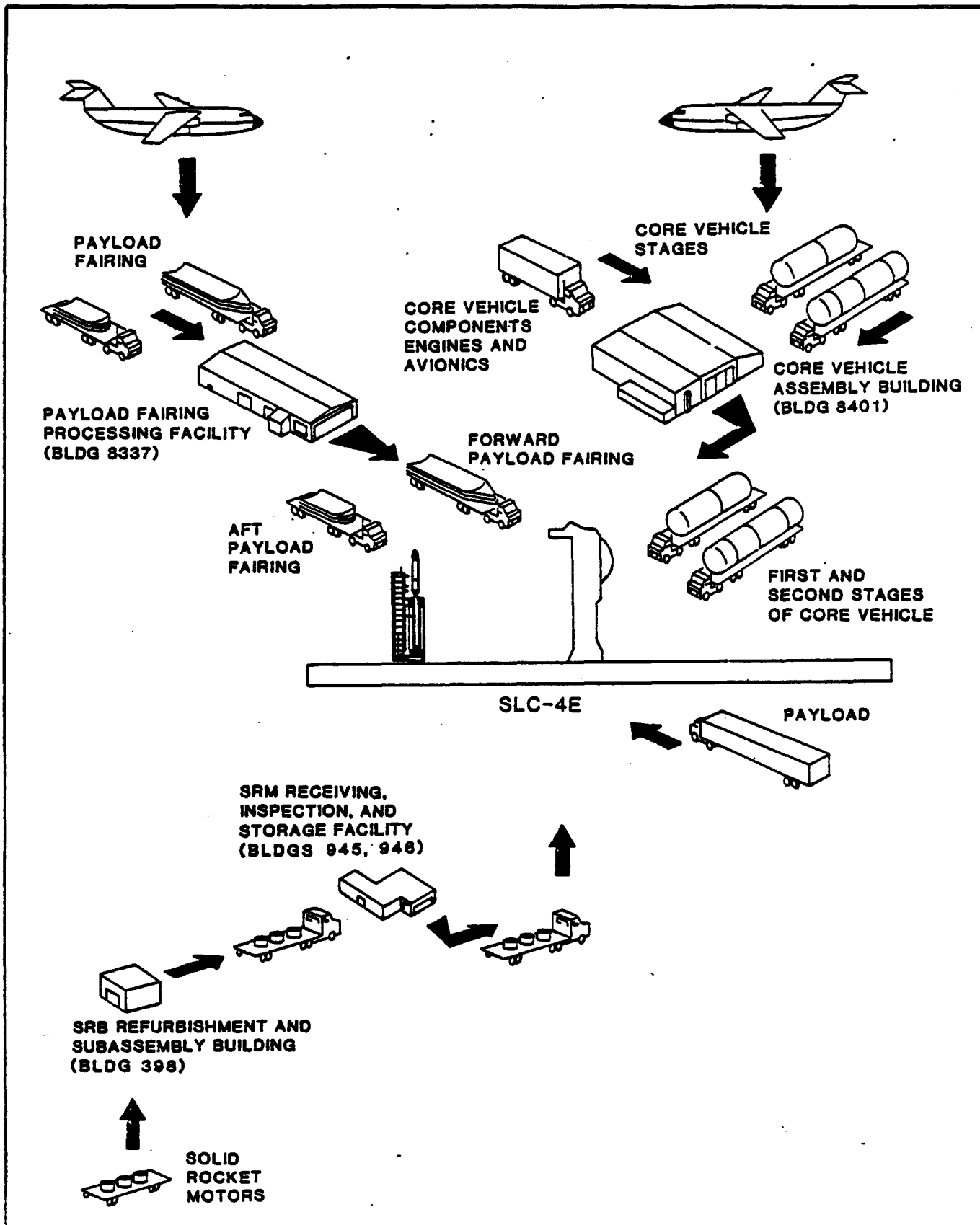


FIGURE 1-5

TRANSPORT OF TITAN IV COMPONENTS ON VAFB

SOURCE: MMC, 1986b

After additional testing of all systems, launch preparations, and propellant loading, the Titan IV space vehicle will be launched.

1.1.1.3 Facility Construction and Modifications

The proposed action consists of modification, construction, and use of facilities on North and South VAFB. On North VAFB, Titan IV activities will include: modifications to two buildings; construction of a new material receiving and inspection facility; and, use of two existing buildings. On South VAFB, Titan IV activities will occur at three locations: in the vicinity of the existing Titan 34D Receipt, Inspection and Storage (RIS) Facility, in the vicinity of and at SLC-4, and in the vicinity of the Space Shuttle launch facilities at SLC-6. The locations of these program facilities in relation to SLC-4 are shown on Figure 1-2. Proposed activities are described in the following paragraphs.

North VAFB Facilities

- Core Vehicle Assembly Building (Bldg 8401) - This facility will be used for: installation of engines and hydraulic systems; engine check-out; and weighing and storage of the vehicle. The vehicle will be transported from this facility to SLC-4E by truck. Modifications to this building will include addition of a new security fence, containment curbs, and gaseous nitrogen tank foundation and footing. These modifications were addressed in the Environmental Assessment for the Titan II Program (ES, 1987). This facility will be shared with Titan II operations. The facility will be further modified for the Titan IV program by the addition of a secure conference room and modification of an existing conference room into a secure conference room.

- Payload Fairing Processing and Storage Building (Bldg 8337) - This facility will be used for: cleaning PLF; applying thermal coating to PLF; painting and insulating PLF; and storage. The PLF will be transported to SLC-4E by a special truck. Modifications to this building consist of increasing the size of the building by 25,000 square feet to accomodate movement of six new bridge cranes, development of a new PLF Clean Area within

the existing structure, and addition of two new paint spray booths, a new solvent storage shed, and new security fencing. Modications to this building were addressed in the Environmental Assessment for the Titan II Program (ES, 1987). This facility will be shared with Titan II operations.

- Materials Receipt and Inspection Facility - A facility to provide additional space for the Titan IV program component handling and distribution is planned for construction on North VAFB. The facility will be approximately 100,000 square feet in size and will be located either near Bldg 8401 or Bldg 5500.

- Material Support Facility (Bldg 5500) - This facility was constructed for the Space Shuttle Program and is known as the Central Supply Facility or V88. Warehouse space in this building will be used in conjunction with Bldg 8401. Five modular trailers have been installed for the Titan II program. Five additional modular trailers will be installed at this location for the Titan IV Program. The trailers will be connected to existing utilities and used as office space for the Titan IV program.

- Construction and Manufacturing Auxiliary Bldg (Bldg 9325) - Maintenance shop support at existing Bldg 9325 will be provided for the Titan II and Titan IV programs. This facility provides vehicle and equipment maintenance and repair for many programs on North and South VAFB. All maintenance related wastes are processed through Bldg 9325.

South VAFB Facilities

- Receipt, Inspection and Storage (RIS) Facility - This facility (Bldg 945) was built for the Titan 34D Program and has been in operation since 1981. It is located off Cooke Road on South VAFB (MMC, 1987b) (see Figure 1-2). It will be used for receiving and inspection of SRM segments, subassembly, checkout, weighing and storage as is currently done for the Titan 34D Program. Modifications to this facility include: increasing its size by constructing additions for non-destructive

evaluation (NDE) support operations; addition of a new Privately Owned Vehicle (POV) parking area west of the building, addition of a 80 x 100 ft modular office building south of the POV parking area, addition of a gaseous nitrogen (GN_2) trailer pad northeast of the building, and extension of paved areas. Modifications to the RIS Facility are shown on Figure 1-6.

- o X-Ray Facility (Bldg 946) - This existing facility is located 750 ft southwest of Bldg 945, and along the RIS Facility access road. This facility will be used to inspect Titan IV solid rocket motors for flaws prior to assembly and launch. X-ray technology will be used to detect voids in the solid propellant. The X-Ray Facility was constructed as part of the restoration and repair activity of SLC-4 and was addressed in the Environmental Assessment for that project (Versar, 1987). Bldg 946 is shown on Figure 1-6.

- o Solid Rocket Booster Refurbishment and Subassembly Building (Bldg 398) - This existing facility was constructed for the Space Shuttle Program. It is located on Coast Road in the SLC-6 area on South VAFB. It will be internally modified to receive and store Titan IV solid rocket motor segments. No exterior modifications are required.

- o Payload Processing Room (PPR) - The PPR is an existing facility at SLC-6 that was built for the Space Shuttle Program. This facility may be used for processing of payloads. No modifications will occur at this building.

SLC-4 Facilities

At SLC-4E, the Mobile Service Tower (MST) will be replaced, the Umbilical Tower will be modified, and a replacement MST Air Conditioning Building will be constructed to accommodate the larger Titan IV vehicle. Additional equipment and structures will be installed at SLC-4E. These activities are shown on Figure 1-7.

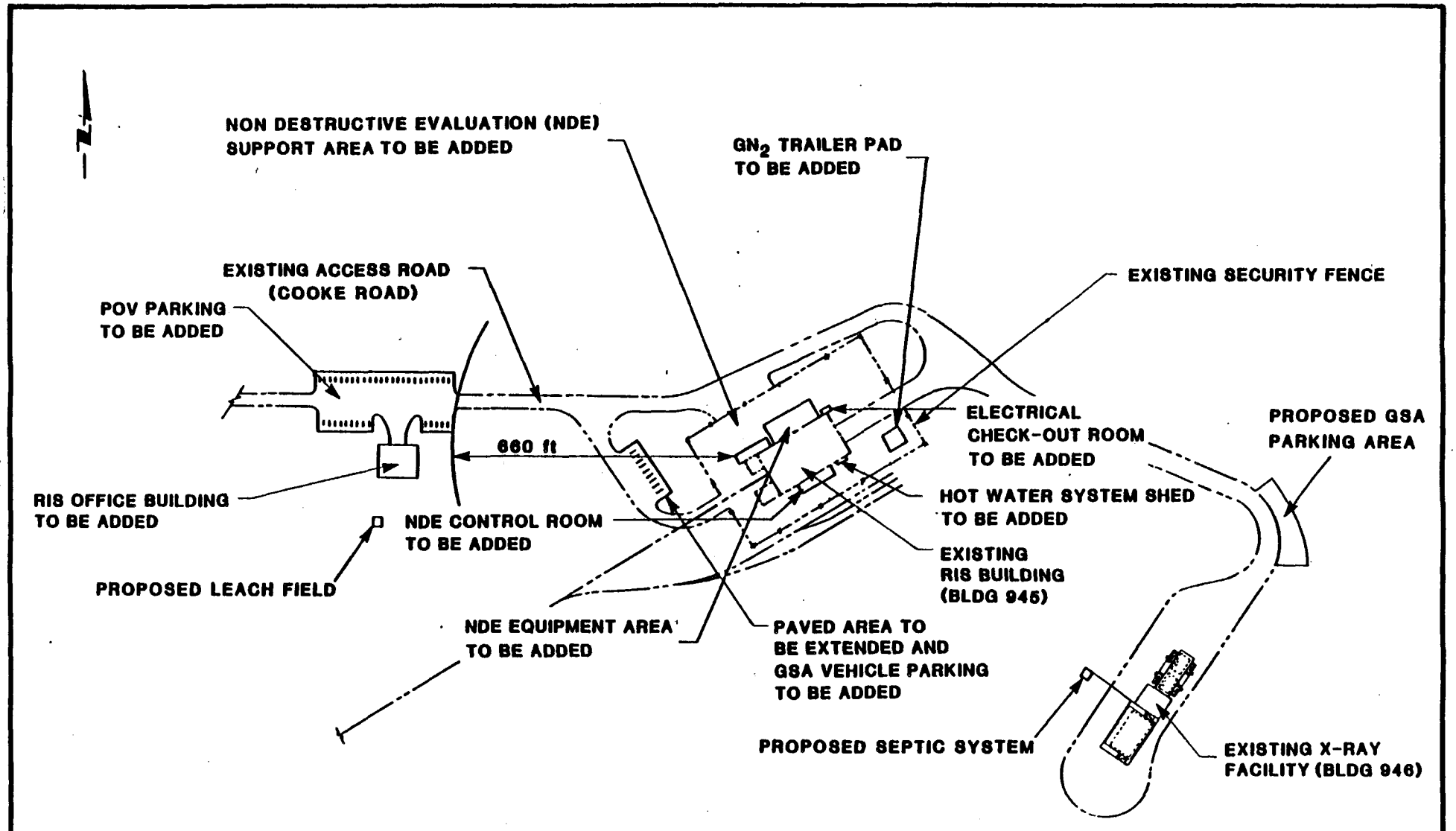
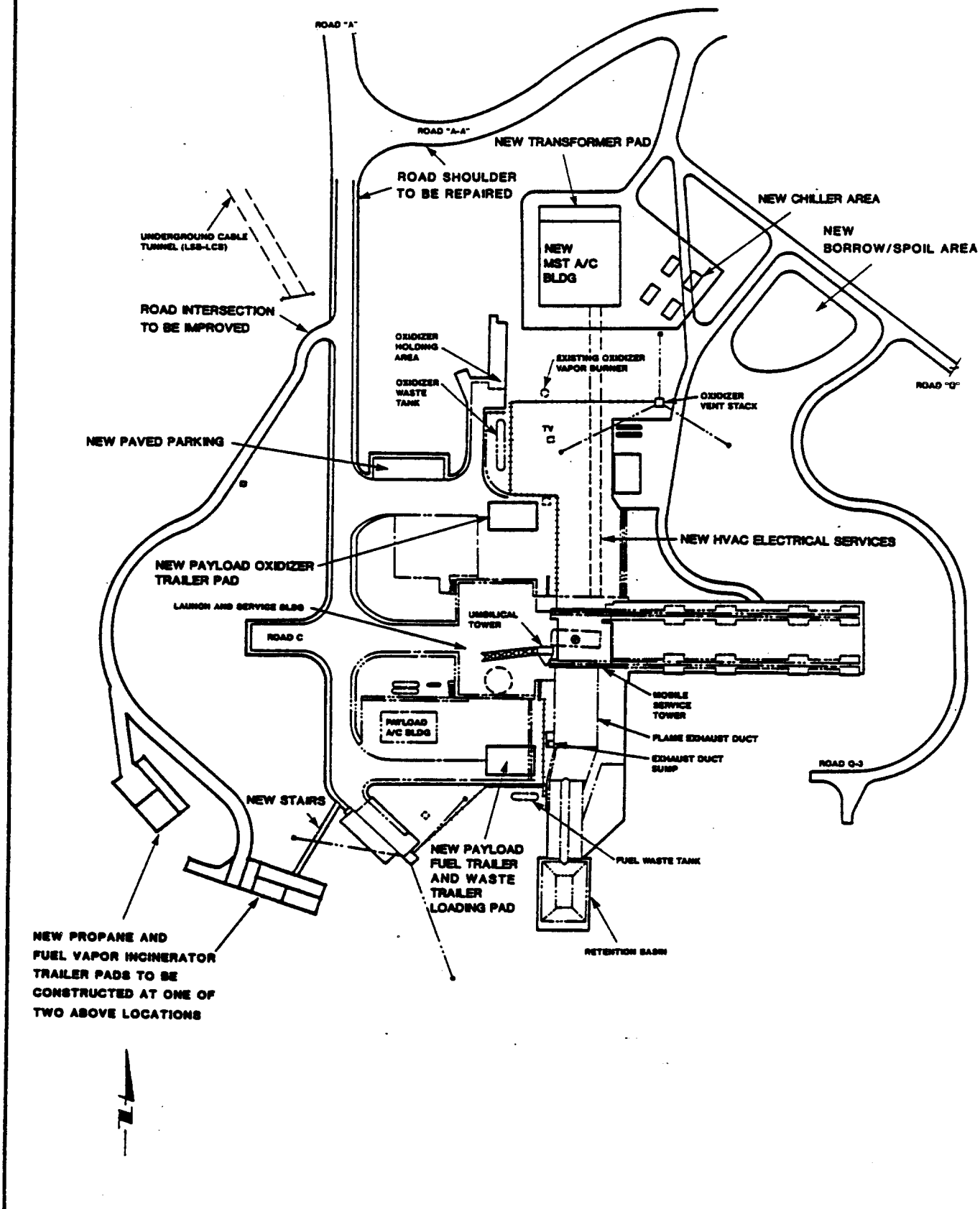


FIGURE 1-6

TITAN IV RECEIPT, INSPECTION AND STORAGE FACILITY (BLDG 945) AND X-RAY FACILITY (BLDG 946)

VANDENBERG AIR FORCE BASE



SOURCE: MMC, 1986

FIGURE 1-7

TITAN IV
SLC-4E LAUNCH FACILITY
VANDENBERG AIR FORCE BASE

In the vicinity of SLC-4, a prefabrication area will be expanded, contractor laydown and support areas will be used, contractor parking areas will be constructed, and an existing road will be improved for transport of modules. Existing electrical power lines will be relocated in the SLC-4 vicinity. Fill material will be obtained entirely from SLC-4E. Proposed activities in the SLC-4 vicinity are shown on Figure 1-8.

SLC-4E Activities

- The existing upper level of the MST structure will be replaced, the size of the clean room enclosure will be increased, payload propellant and electrical services will be added, new MST undercarriages and a new drive system will be added, and platforms will be modified.
- Umbilical Tower modifications include increasing its height, moving booms up and extending electrical and mechanical lines.
- A new and larger 1-story MST Air Conditioning Building will be built north of the existing structure, which will be removed. A new gravel road, retaining wall and utility tunnel will be added.
- An existing contractor laydown and support area at SLC-4E will be used on a temporary basis. Aerospace ground equipment and support area will be used in the Live End Item Storage (LEIS) area. The contractor's field office, craft change rooms, tool vans, warehouse, and subcontractor offices will be installed as modular structures in the immediate SLC-4E area near the Launch and Service Building.
- Other modifications to SLC-4E include: extension of the existing craft parking area, addition of a fuel vapor incinerator and concrete trailer pad, propane trailer pads, payload fuel trailer pad, payload oxidizer trailer pad, and a new paved parking area. The intersection of the existing security road to the propane trailer pad will be improved. Existing road shoulders along Road "A" and Road "A-A" will be

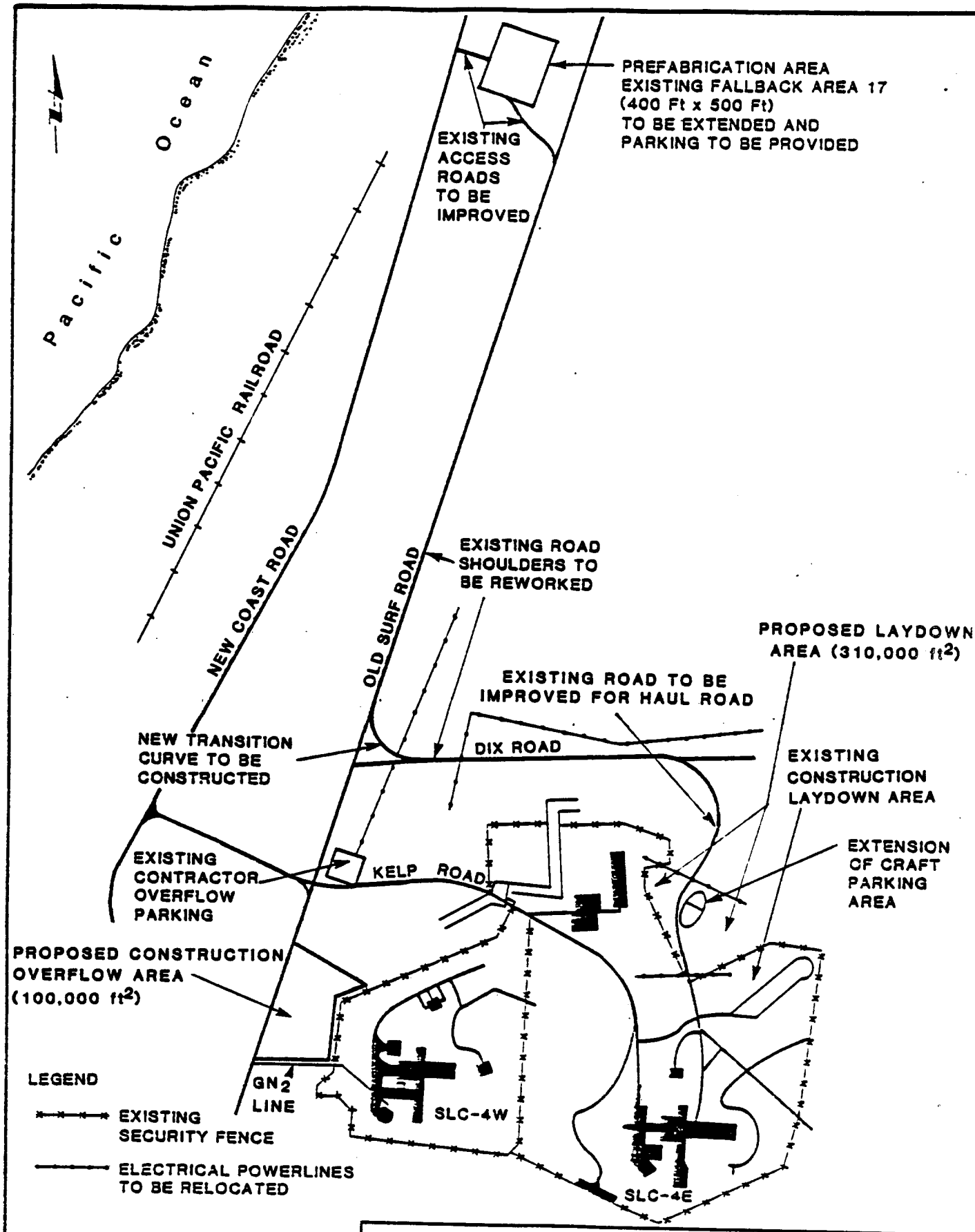


FIGURE 1-8

TITAN IV CONSTRUCTION ACTIVITIES AT SLC-4

VANDENBERG AIR FORCE BASE

repaired. A stairway from the fuel trailer pad area to the fuel vapor incinerator pad will be constructed.

SLC-4 Area Activities

- Five and one half acres to the northwest of SLC-4 at existing Fallback Area 17 between Old Surf Road and New Coast Road will be used for a temporary construction prefabrication area. This site will be used for: assembly of the four modules for the new upper level structure for the MST; assembly of seven other modules; and, other preassembly work. The site is also proposed for location of the prefabrication contractor's main field office, warehouse, and laydown area. Some additional clearing and gravel surfacing will take place south of the existing 4.5-acre laydown area in order to increase its size by approximately one acre.

- An existing road will be improved for a haul road from the Launch and Service Building at SLC-4E to Dix Road. The temporary haul road will be used to transport modules and will be 40 feet in width and approximately 0.5 mile in length. Embankments will require approximately 5,000 cubic yards of borrow material, which will be available from the borrow site shown on Figure 1-7. A new transition curve from Dix Road to Old Surf Road will be constructed.

- Existing road shoulders on Dix Road and Old Surf Road from the proposed haul road to the prefabrication area at Fallback Area 17 will be reworked as necessary to provide a 30-foot travel-way along existing roads approximately 1.0 mile in length. Coast Road will also be used; however, no roadwork will be required.

- Temporary parking areas for contractors will be made available in the vicinity of the prefabrication area north of SLC-4. Existing contractor overflow parking will also be used.

- Four existing overhead utility lines between Old Surf Road and SLC-4E will be buried in place to accomodate module clearances during transportation from the Fallback Area 17 prefabrication area.

- Approximately 310,000 square feet of existing construction laydown area within the upgraded SLC-4 security fence will be used for laydown, storage and prefabrication. This area has previously been addressed in the Environmental Assessment for the Repair and Restoration of SLC-4 (Versar, 1987).
- Approximately 100,000 square feet of construction overflow area west of SLC-4W adjacent to Old Surf Road will be used. This area was used in the past for a parking lot. The Titan IV program will be limited to use of only the previously disturbed area at this location.

All of the above Titan IV construction and modifications at SLC-4 will require a total of approximately 30,000 cubic yards of fill material. The borrow site at SLC-4E, as shown on Figure 1-7, will be excavated to provide 5,000 cubic yards of fill material. Approximately 25,000 cubic yards of additional fill material will be available from excavation for the new MST Air Conditioning Building.

1.1.1.4 Personnel Requirements

Modification and construction of Titan IV program facilities will result in the presence of approximately 474 temporary construction personnel on South VAFB. During launch of the Titan IV space vehicle, 430 personnel will be present on South VAFB. It is expected that 300 operational personnel will be present on South VAFB during non-launch periods. These personnel projections do not represent any significant increase over personnel present for such operations of the current Titan 34D Program. A breakdown of personnel projections at each Titan IV facility is provided in Section 2.2.1.1. Personnel projections for North VAFB facilities common to Titan II and Titan IV construction and operations were included in the Environmental Assessment for the Titan II Program (ES, 1987).

1.1.1.5 Launch Process Operations

The processing of Titan IV components in preparation for pre-launch testing, launching, and post-launch activities will involve the use of numerous chemical agents and materials such as paint, solvent, adhesive, freon, oil, ink, and deluge/washdown water.

All waste generated by the Titan IV program will be handled and disposed of in accordance with all applicable federal, state, and base requirements. Air emissions from process operations are quantified in Section 2.1.2.2. Hazardous waste from the Titan IV program is discussed in Section 2.2.3.

1.1.1.6 Propellants

The Titan IV space booster uses solid and liquid propellants. The solid propellant used for Stage Zero is UTP-3001B. The liquid fuel is Aerozine-50 and the oxidizer is N_2O_4. The Titan IV uses the same constituents as the Titan 34D and IIID, only in greater amounts. Table 1-2 provides a comparison of propellants for the Titan IV, Titan II, and other previously or currently launched vehicles at SLC-4.

Propellant vapor from Titan IV operations at SLC-4E will be vented to a fuel vapor incinerator and an oxidizer vapor burner which will be permitted by the Santa Barbara County Air Pollution Control District. The small amount of vapor released during payload propellant handling operations will also be vented into the N_2O_4 vapor burner or the fuel vapor incinerator, as appropriate.

1.2 ALTERNATIVE ACTIONS

There are two proposed alternative actions to the Titan IV program at VAFB. The selection criteria were based on economics, ability to meet technical requirements, ability of the launch vehicle to place DOD satellites in orbit on schedule, and the ability to provide an assured access to space of Space Shuttle class payloads.

The first alternative would be the launching of a different type of vehicle from SLC-4E, which would involve different modifications to the launch complex. This alternative would consist of either modification of existing space launch vehicles or development of new space launch vehicles. Implementation of this alternative would result in the same basic types of environmental impacts as the proposed action.

The second alternative would be the launching of the Titan IV from a different launch complex at VAFB. This alternative would involve modification of a different launch area and would result in similar

TABLE 1-2

COMPARISON OF PROPELLANTS USED BY
VEHICLES LAUNCHED FROM SLC-4
VANDENBERG AIR FORCE BASE

Vehicle	Propellant Type	Quantity (lb, except where noted)
TITAN IV (Proposed)		
Stage Zero	Solid Rocket Propellant	1,183,384
Stage One	N_2O_4/Aerozine-50	230,195/120,638
Stage Two	N_2O_4/Aerozine-50	50,681/28,363
Thrust Vector Control (TVC) System	N_2O_4	16,848
Payload(s)	N_2O_4	12,100
	N_2H_4	8,400
	MMH	7,300
Total	Solid Rocket Propellant	1,183,384
	N_2O_4	309,824
	Aerozine-50	149,001
	N_2H_4	8,400
	MMH	7,300
TITAN II		
Stage One	N_2O_4/Aerozine-50	170,015/89,947
Stage Two	N_2O_4/Aerozine-50	37,787/21,519
Attitude Control System	N_2H_4	90
Payload(s)	N_2H_4	900
Total	N_2O_4	207,802
	Aerozine-50	111,466
	N_2H_4	990
TITAN 34D		
Stage Zero	Solid Rocket Propellant	929,400
Stage One	N_2O_4/Aerozine-50	195,164/103,227
Stage Two	N_2O_4/Aerozine-50	44,532/25,038

TABLE 1-2 (Cont'd)

Vehicle	Propellant Type	Quantity (lb, except where noted)
TITAN 34D (Cont'd)		
TVC System	N_2O_4	16,048
Payload	N_2O_4	5,500
Total	Solid Rocket Propellant	929,400
	N_2O_4	261,244
	Aerozine-50	128,265
TITAN IIID		
Stage Zero	Solid Rocket Propellant	870,000
Stage One	N_2O_4/Aerozine-50	195,164/103,227
Stage Two	N_2O_4/Aerozine-50	44,532/25,038
TVC System	N_2O_4	16,048
Payload(s)	N_2O_4	5,200
Total	Solid Rocket Propellant	870,000
	N_2O_4	260,944
	Aerozine-50	128,265
Titan IIIB		
Stage One	N_2O_4/Aerozine-50	195,877/101,898
Stage Two	N_2O_4/Aerozine-50	43,113/24,385
Payload(s)	N_2H_4/HDA	900/1,000
Total	N_2O_4	238,990
	Aerozine-50	126,283
	N_2H_4/HDA	900/1,000
ATLAS-AGENA D		
Atlas	LOX	18,398 gallons
	RP-1	11,139 gallons
Agena	UDMH	568 gallons
	IRFNA	736 gallons

Note: Payload propellant quantities are maximum estimates.
Source: USAF, 1986a, 1975.

types of environmental impacts occurring in a different location. Because of its previous use for Titan launches, the ability to adapt SLC-4 to future planned launch requirements surpasses that of any other potential launch facility at VAFB.

1.3 NO-ACTION ALTERNATIVE

If the Titan IV program were not implemented as planned, the United States would be forced to depend on the Space Shuttle for launch of large high-priority national security payloads from the West Coast. Under the no-action alternative, payloads scheduled to be carried on Titan IV vehicles would have to be launched from Space Shuttle vehicles. The number of payloads awaiting access to space by the Space Shuttle has increased due to the backlog which has resulted from the January 1986 Space Shuttle accident at Kennedy Space Center. It will take several years to schedule a sufficient number of Space Shuttle launches from VAFB to accommodate this backlog. Meanwhile, high-priority national security payloads must be launched into polar orbit from VAFB. The Vandenberg Space Shuttle will not be available to meet launch schedule requirements. The environmental impacts of launching the Space Shuttle from VAFB are documented in the Final Environmental Impact Statement (EIS) for the Vandenberg Space Shuttle (USAF, 1978) and EIS Supplement (USAF, 1983a). Under the no-action alternative, SLC-4 and other program related areas on North and South VAFB would remain in their present condition.

The DOD has determined that there is a need for assured access to space for critical national defense payloads through a launch capability using expendable launch vehicles. The Titan IV space launch program has been identified as the space launch vehicle to provide DOD with assured access to space. The no-action alternative would not fulfill this national security requirement.

SECTION 2

ENVIRONMENTAL DESCRIPTION AND IMPACTS

2.1 NATURAL ENVIRONMENT

2.1.1 METEOROLOGY

2.1.1.1 General Description

The climate in Santa Barbara County is typical for coastal southern California and is categorized as Mediterranean or dry and subtropical. During the summer, the area is characterized by persistent night and morning low cloudiness and fog, which results in restricted visibility. This condition clears in the afternoon due to the onset of a sea breeze by mid-day and the continued heating of the air mass.

Throughout the year, the prevailing wind direction is northwesterly and westerly. During the winter, the flow reverses to a prevailing southeasterly direction under pre-storm conditions. Nighttime winds, however, are from the east and north.

During the fall and early winter (and occasionally during late spring and early summer), the area is subject to Santa Ana winds. These strong, gusty winds are warm and dry and travel from the inland desert, through the mountain valleys, and out onto the ocean. High ozone levels recorded in Santa Barbara County have been attributed to Santa Ana winds, which are thought to transport the ozone precursors to the area from inland sources within the Los Angeles basin (Chambers, 1986).

Wind speeds in the area are light throughout the year and vary with time of day. Exceptions occur along the coast, on exposed ridges, or when a strong storm and frontal system is present. Wind speeds generally increase during the day and peak in the afternoon. Sea

breezes, which result from differential heating of land and sea, flow onshore during the day. Weaker land breezes flow offshore at night.

Temperatures along the coast are mild, ranging from 45° to 85°F. Temperatures below freezing and above 100°F are rare. Temperature differences on land and at sea are greater in the winter than in the summer. Greater fluctuations in temperature occur inland with increasing distance from the ocean, as well as with greater elevation.

During the summer, the area experiences a persistent subsidence inversion, a phenomenon where cooler, more stable air lies below warmer air and results in pollutants being trapped in the area. The inversion layer limits the mixing height to less than 2,000 feet above the ground. During the other three seasons, surface inversions form in the early morning when the ground cools more rapidly than the air above.

The wet season in southern California extends from November to April and generally consists of fair weather with occasional cloudiness and rainshowers. Precipitation is mainly in the form of rain along the coast and in lowland areas, and may occur as both rain or snow in the higher mountainous areas. Annual rainfall averages 14 inches, but may range from 10 to 30 inches, 90 percent of which occurs during the wet season.

Thunderstorms average about two to three occurrences per year. The intensity of these storms is usually weak. They usually occur during the winter when storms are associated with cold fronts and in September when moisture moves into the region from the south or southeast.

2.1.1.2 Site-Specific Characterization

The coastal location of VAFB results in a moderating influence of the ocean on the temperature and moisture content of the air and a narrow range of values for these two meteorological parameters. The average annual temperature is 55°F. The mean annual relative humidity recorded at the VAFB airfield is 77 percent. Low relative humidity (less than 10 percent) is occasionally experienced during the occurrence of a Santa Ana wind condition. This temporary condition is caused by a high-pressure cell stalled over the Colorado Plateau. This phenomenon

causes air to flow in an offshore direction, resulting in heating by compression as the air descends from the upper desert to sea level.

The average annual precipitation for the VAFB region is 12.7 inches. The wettest month is usually February, when most of the extratropical storms from the southwest move inland. The mean monthly precipitation for February is 2.6 inches. July is usually the driest month, with a 0.01-inch mean monthly precipitation.

The widely varying terrain at VAFB results in a great variation in local wind speed and direction. In general, winds are stronger on the higher ridge lines, along the beaches, and on Sudden Ranch. The average maximum diurnal wind speed (about 17.3 mph at 3 p.m.) at South VAFB is greater than that at North VAFB (about 5.8 to 8.0 mph at 4 p.m.). The mean annual surface wind speed is 7.0 mph from a predominantly northwesterly direction. Mean maximum gusts of wind up to 47.2 mph have been experienced during January, February, and March. Wind roses developed from data gathered at the VAFB Watt Road Air Monitoring Station (on North VAFB) are presented in Figures 2.1.1-1 to 2.1.1-4.

Reduced visibility in the VAFB region is due largely to coastal fog, which occurs primarily during July, August, and September. Ground fog is usually confined to late evening and morning hours, but may persist in the nearshore area throughout the day. Visibilities of 0.25 mile or less occur approximately 5 percent of the time during early morning hours.

Clouds are common in the VAFB area, averaging about 48 percent cloud cover annually. The total cloud cover is greater at North VAFB than at South VAFB. The average annual ceiling height is approximately 1,000 feet, depending on the base height of the inversion layer.

2.1.1.3 Pre-Launch Meteorological Monitoring

The climatology and geography of VAFB require special considerations prior to a decision to launch. At VAFB, the prevailing wind direction is onshore and the distance from the launch pad to the nearest uncontrolled inland area is only 4 miles. Moreover, a subsidence inversion layer persists over the area most of the day, thereby limiting vertical dispersion. These meteorological conditions

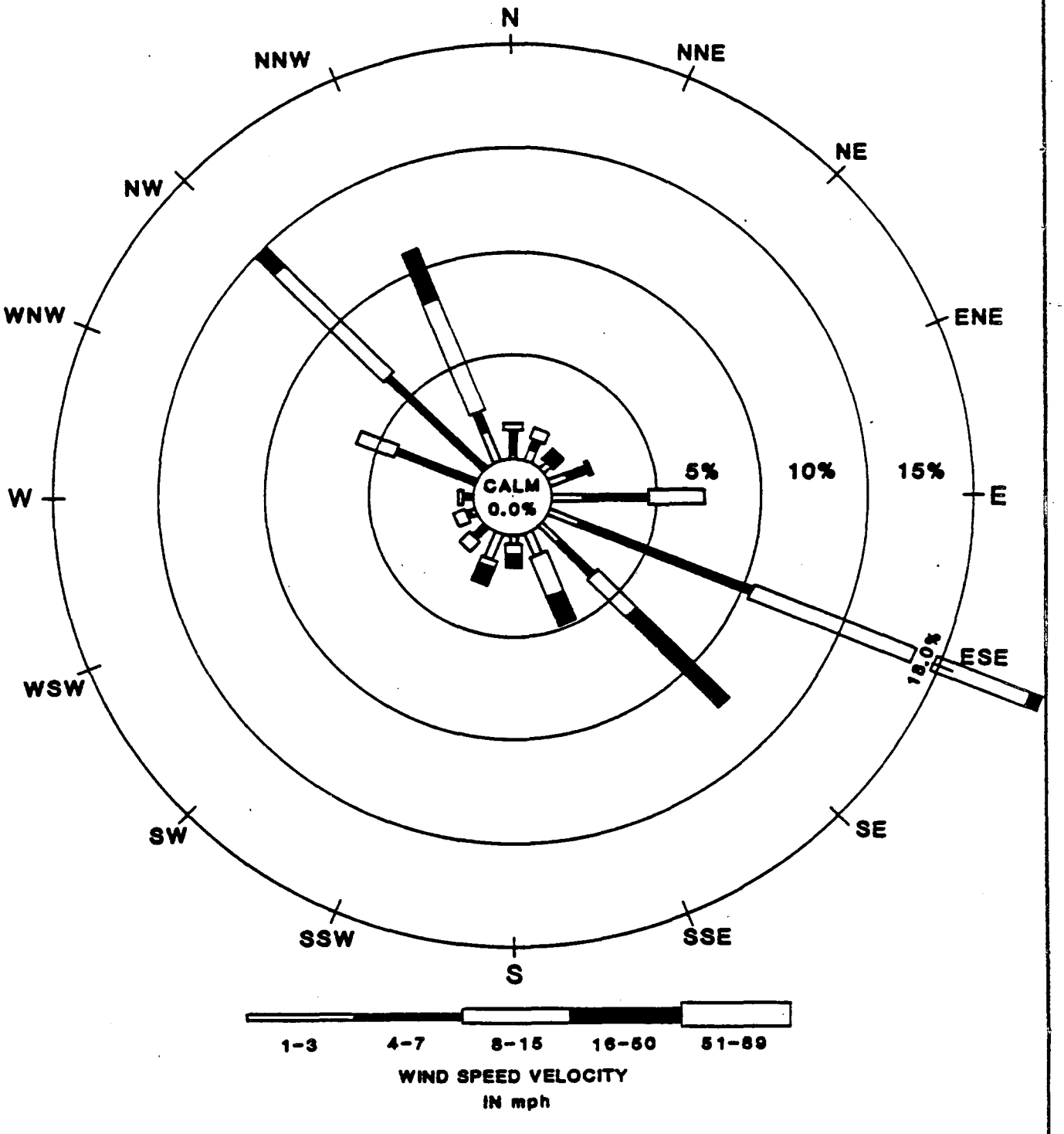


FIGURE 2.1.1-1

JANUARY 1986 WIND ROSE

(WATT ROAD STATION)

VANDENBERG AIR FORCE BASE

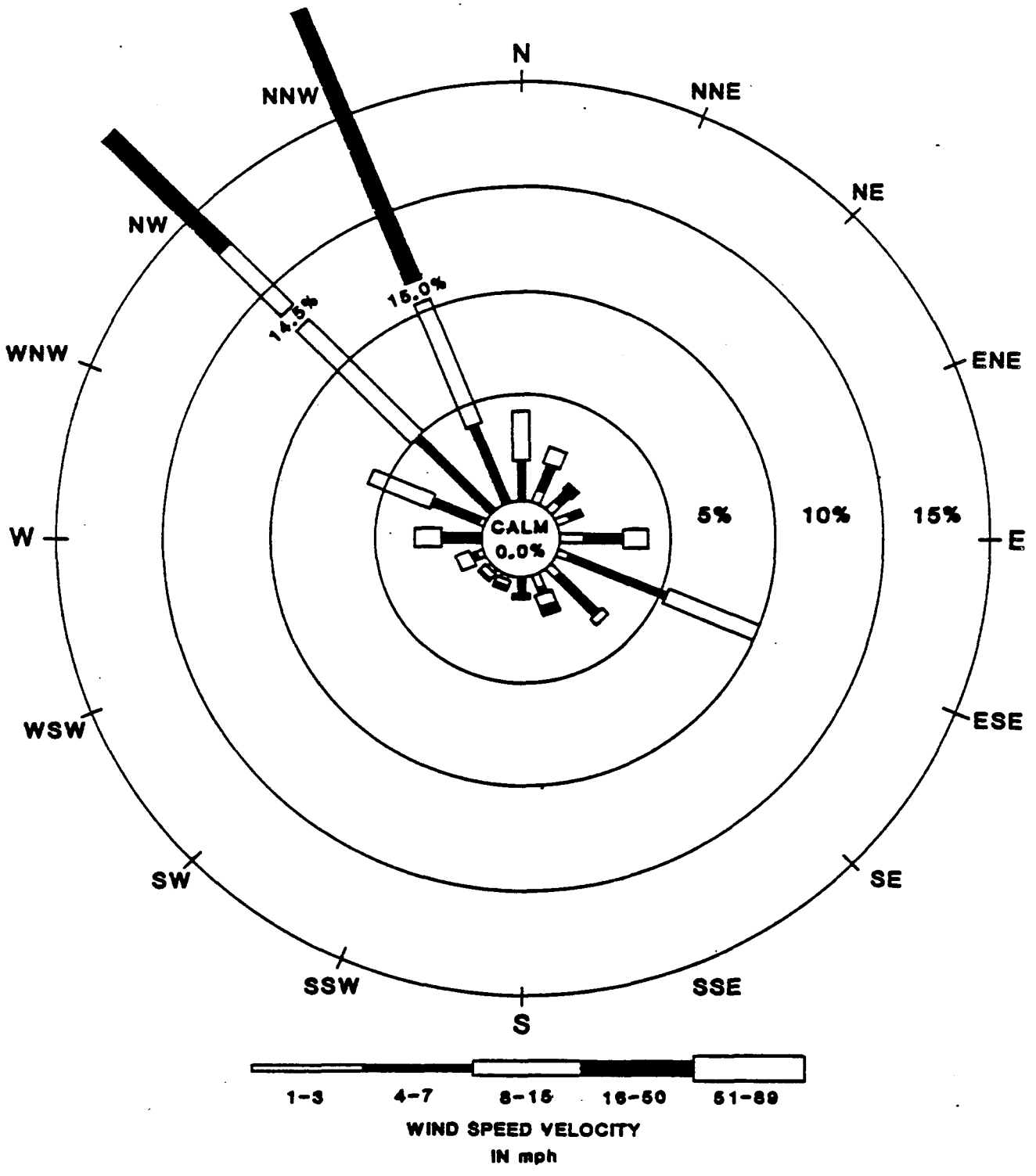


FIGURE 2.1.1-2

APRIL 1986 WIND ROSE

(WATT ROAD STATION)

VANDENBERG AIR FORCE BASE

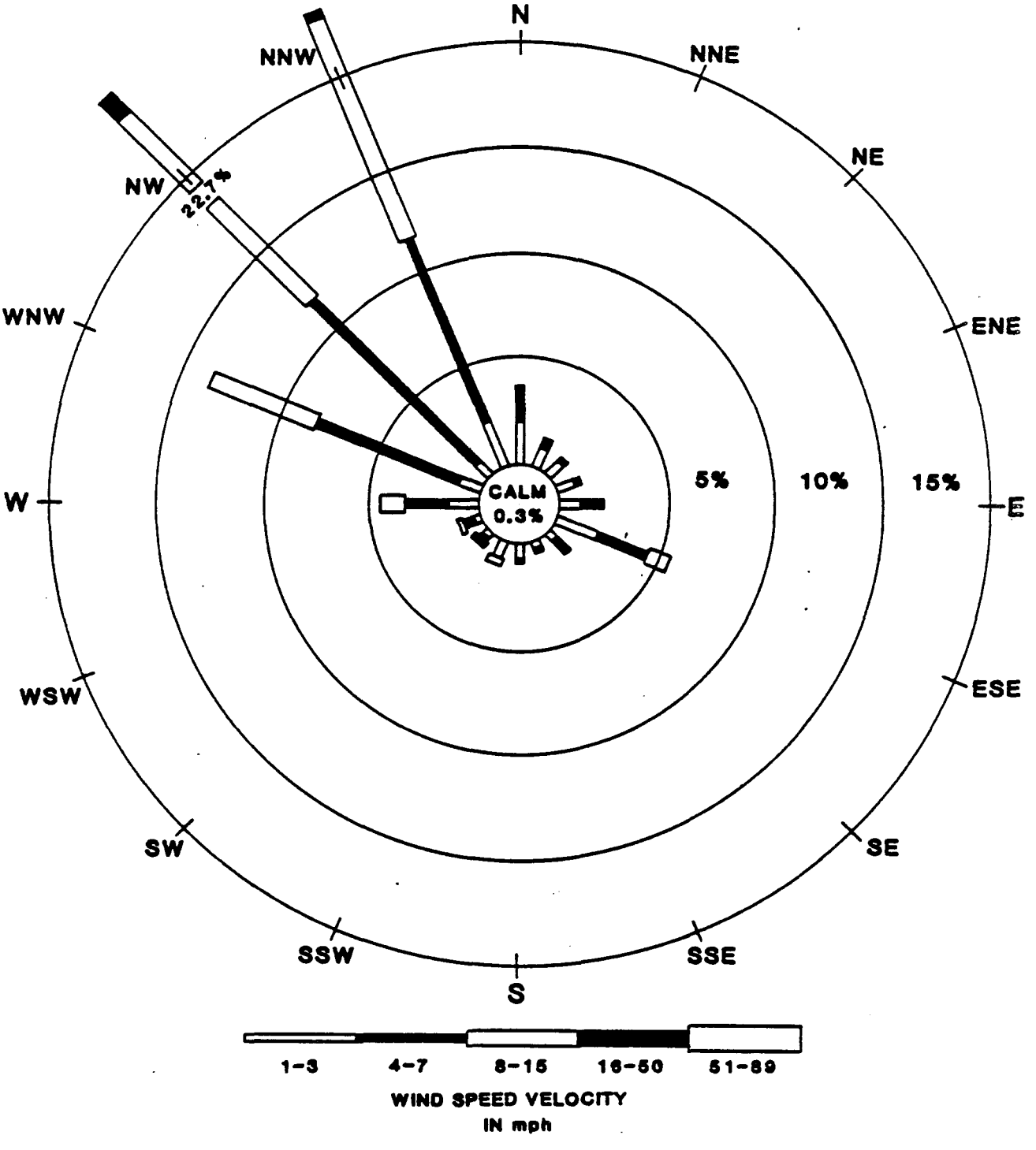


FIGURE 2.1.1-3
JULY 1986 WIND ROSE
(WATT ROAD STATION)
VANDENBERG AIR FORCE BASE

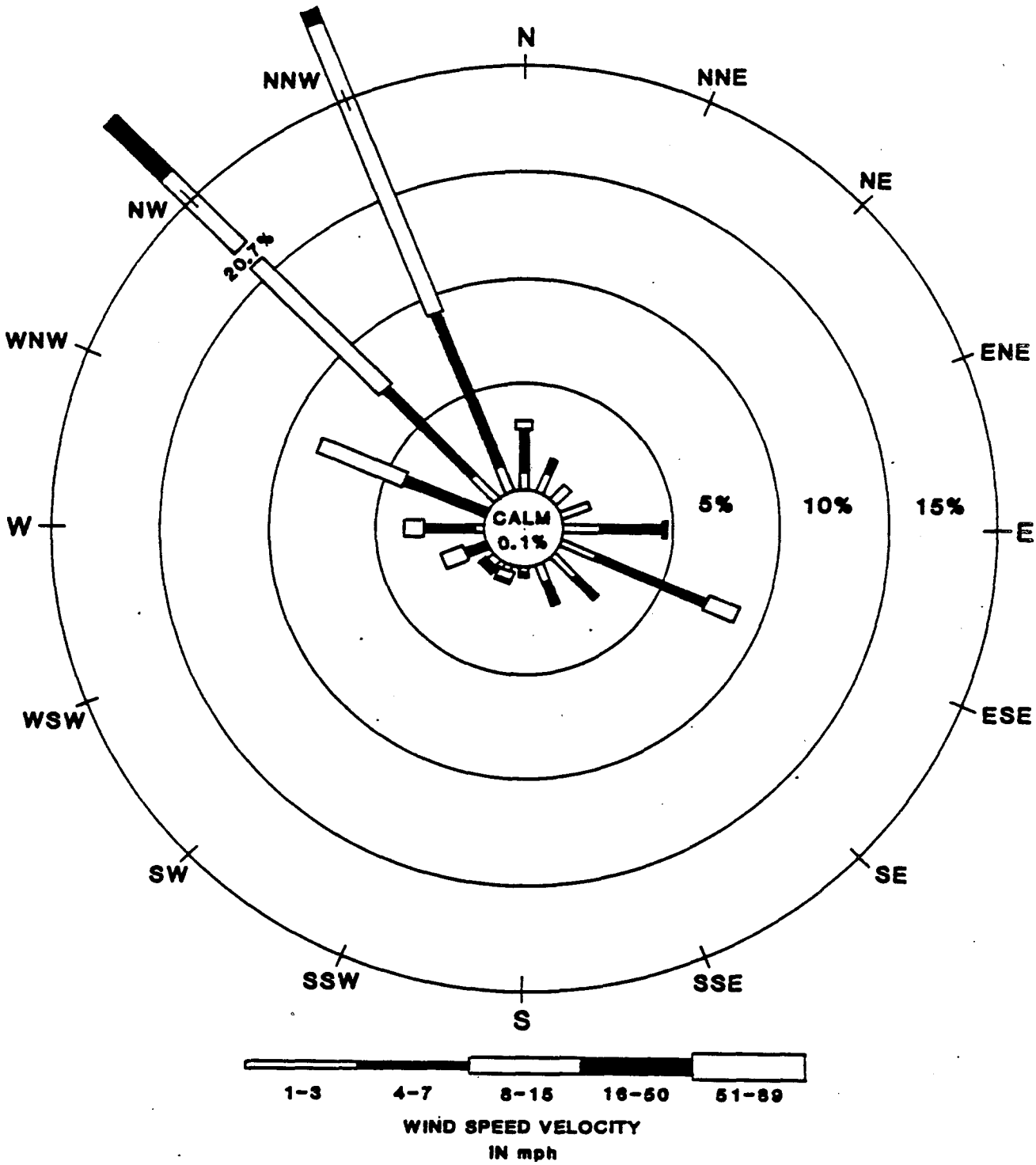


FIGURE 2.1.1-4
SEPTEMBER 1986 WIND ROSE
(WATT ROAD STATION)
VANDENBERG AIR FORCE BASE

can cause the transport of air pollutants from launch operations into uncontrolled areas, with subsequent adverse effects on the local population. Such conditions are identified by the Toxic Hazard Corridor (THC) forecast and are launch constraints.

Because of these constraints, the THC forecast is prepared to assist operational personnel in determining favorable launch conditions. The forecast is prepared by the USAF duty forecaster using information gathered by the Weather Information Network and Display System (WINDS). The WINDS program is a network of meteorological observation towers that are located at representative locations throughout VAFB and range in height from 6 to 300 feet. The meteorological data gathered by these stations are transmitted to a central receiving station, where the data are processed by a computer and presented on a scaled map display panel. Weather parameters as observed at each of the stations are displayed at discrete intervals. In addition, these data are called up from the computer for use in meteorological prediction programs.

The THC forecast is continuously monitored and modified when necessary. The actual THC forecast contains the meteorological data from WINDS on which the forecast is based (wind speed and direction, temperature changes, and wind direction variability), an arc that would enclose a toxic spill, and the downwind distance that would be the limit of hazardous vapor. The forecast is valid for no more than two hours.

The following occurrences will normally impose a "hold" or "no-go" condition for any operation involving the use of a THC (USAF, 1983b):

1) the USAF weather forecaster is unable to predict a clearly defined THC;

2) the THC is predicted to overlay any portion of an inhabited uncontrolled area, i.e., a nonoperational area that cannot be rapidly evacuated (all onbase cantonment, housing, and hospital areas and all offbase areas are in this category);

3) an inversion layer exists below 800 feet mean sea level (MSL) and the wind direction is toward any inhabited uncontrolled area (presence of an inversion layer will be determined by the USAF forecaster only);

4) a thunderstorm is approaching the area and is within an estimated 3 miles of SLC-4E (a thunderstorm is defined as a storm in which lightning is visible or one that the meteorologist describes as a thunderstorm);

5) the THC is predicted to be a nonmoving circular area over the operation and visibility is so poor that the plume cannot be seen (i.e., during the hours of darkness combined with heavy fog); and/or

6) heavy rain is present and seriously restricts the vision of operational personnel.

These conditions would not impose a "hold" or "no-go" condition on launch operations during a non-peacetime mission or if so directed by the USAF launch director.

2.1.2 AIR QUALITY

2.1.2.1 Description of Local Air Quality

VAFB is located in the California South Central Coast Air Basin, which encompasses the counties of Ventura, Santa Barbara and San Luis Obispo. Santa Barbara County is divided into North and South County and VAFB is within North County.

VAFB installed and maintains air monitoring stations as part of the State and Local Air Monitoring Stations (SLAMS) program established for the Santa Barbara County Air Pollution Control District (SBCAPCD). VAFB currently maintains two stations on VAFB and one in the City of Lompoc, as shown In Figure 2.1.2-1. The monitors on VAFB are located at Watt Road in the northwestern portion of VAFB and on South VAFB near SLC-6. The air monitor in the City of Lompoc is located at "H" Street.

Five pollutants are monitored at these stations: ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and total suspended particulate (TSP). These are five criteria pollutants

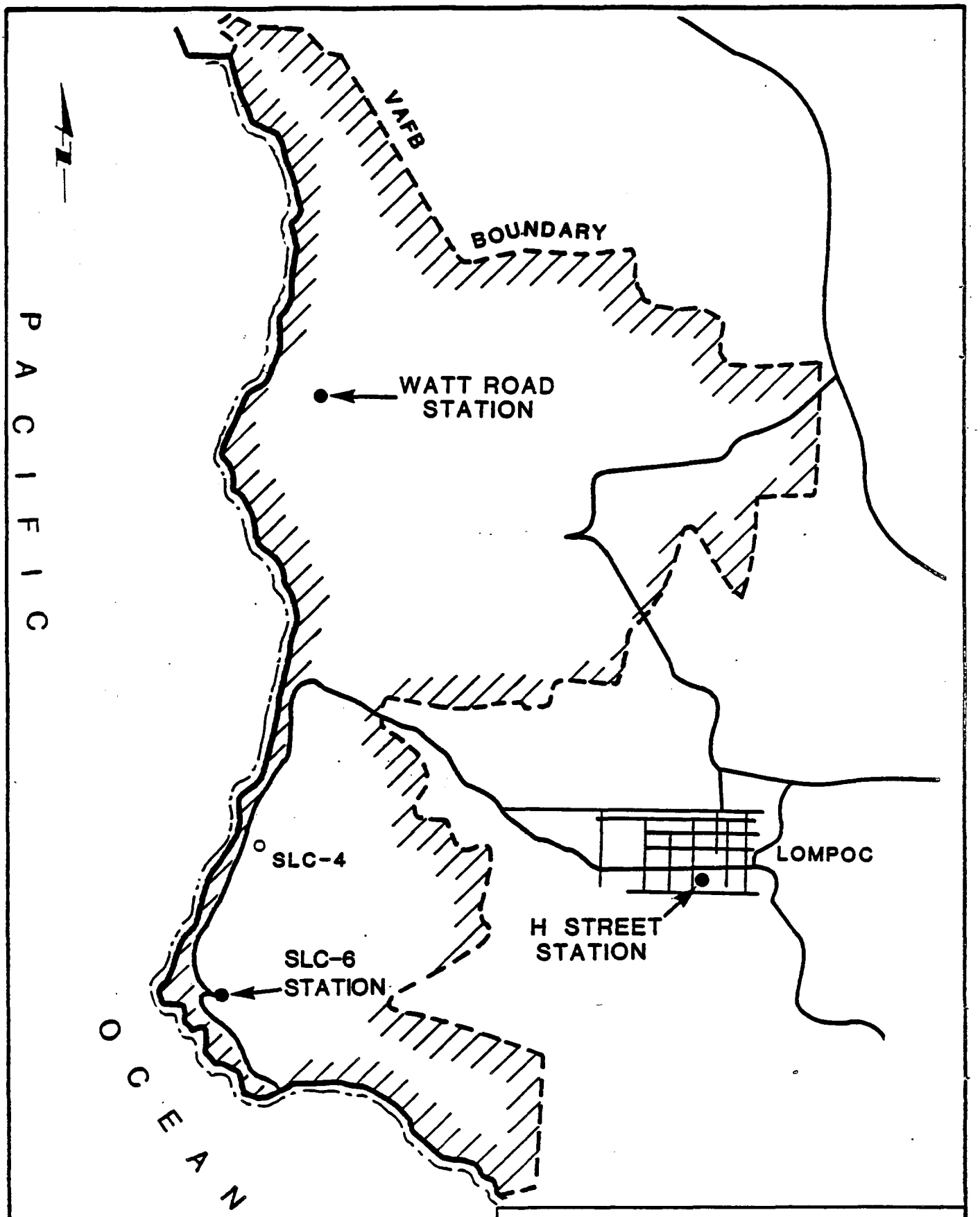


FIGURE 2.1.2-1

AIR MONITORING STATIONS OPERATED BY VAFB

which are monitored for compliance with national and state ambient air quality standards. The state ambient standards have recently been revised to replace the TSP standard with a standard for particulate matter less than 10 microns in diameter (PM_{10}).

An area is designated as attainment for a particular criteria pollutant if ambient concentrations in the area are below the corresponding ambient standard. Currently, a 15-mile radius around Santa Maria is designated as non-attainment for PM_{10}. The North County portion of Santa Barbara County is currently designated as an attainment area for ozone under federal ambient standards. Recently, North County has exceeded the state ozone standards on several occassions. On October 27, 1987, the SBCAPCD made a presentation to its Board of Directors for redesignation of North County as non-attainment for ozone. North County will continue as a federal attainment area for ozone until approval for redesignation is given by the EPA. For purposes of assessing compliance with applicable SBCAPCD rules, however, the SBCAPCD non-attainment designation for ozone stands and all new sources in North County will undergo New Source Review (NSR). Best Available Control Technology (BACT) maximum emission levels for non-attainment criteria pollutants and their precursors will be limited to 2.5 lbs/hr.

Air quality data recorded at the Watt Road station for 1986 will form the baseline air quality upon which impacts to air quality will be assessed. Baseline air quality is the existing air quality at the project site prior to implementation of the project. Data recorded at the Watt Road station were chosen to represent the air quality of the impact area because this station is located at a site that resembles the relatively remote location of the Titan IV launch area, where there are fewer sources contributing to local air quality conditions. These data are presented in Table 2.1.2-1.

To complete the baseline air quality data, PM_{10} data recorded at Santa Maria indicate that the 1986 annual geometric mean for PM_{10} was 29.3 ug/m^3 and that the highest and second highest measured 24-hour average concentrations were 73 and 65 ug/m^3, respectively (CARB, 1987). There were no PM_{10} measurements conducted at any of the monitoring stations at VAFB or in the City of Lompoc.

TABLE 2.1.2-1

1986 SUMMARY OF AIR QUALITY DATA AS MEASURED AT VAFB WATT ROAD STATION

Pollutant	Highest Measured Concentration
Ozone (O_3)	
1-hour average	0.10 ppm
Carbon Monoxide (CO)	
1-hour average	1.00 ppm
Nitrogen Dioxide (NO_2)	
1-hour average	0.04 ppm
Sulfur Dioxide (SO_2)	
1-hour average	0.01 ppm
3-hour average	0.007 ppm
24-hour average	0.0013 ppm
Total Suspended Particulate (TSP)	69 ug/m^3

Source: XonTech, Inc., 1986.

A review of the air quality data and a comparison with State and Federal standards indicate exceedances of the state ozone standard (0.10 ppm, 1-hour average) at VAFB. The state PM_{10} 24-hour standard (50 ug/m^3) was exceeded in Santa Maria. The measured PM_{10} 1986 annual geometric mean in Santa Maria is only slightly less than the state standard of 30 ug/m^3.

2.1.2.2 Description of Emissions

Emissions from the Titan IV program are divided into the following five categories:

1) emissions from facility construction and modification;
2) emissions from the preparation and assembly of the space launch vehicle;
3) emissions from pre-launch and post-launch processing;
4) emissions from the launch; and
5) emissions from vehicle failure.

A. Construction and Modifications

To support the Titan IV program, several new construction projects and modifications to existing facilities at VAFB as described in Section 1.1.1.3 are proposed. These projects involve some ground-disturbing activities such as excavating, filling, and grading. Such activities involve the use of heavy duty earth-moving equipment. Pollutants generated from the construction and modification of associated space launch support facilities are fugitive dust and exhaust emissions such as carbon monoxide, nitrogen oxides, and reactive hydrocarbons.

Fugitive dust generated from ground disturbing activities is estimated based on emission factors published by the U.S. Environmental Protection Agency in AP-42, "Compilation of Air Pollutant Emission Factors." With a total construction acreage of 9.5 acres projected over a period of 2 months (only for earthwork activities), estimated uncontrolled fugitive dust emissions would total 22.80 tons. An effective watering program (that is, twice daily watering with complete coverage) is estimated to reduce dust emissions by up to 50 percent (EPA, 1972). Spraying with water would result in fugitive dust emissions totalling 11.4 tons.

Exhaust emissions from heavy-duty construction machinery could be estimated if the types and numbers of equipment were known. These exhaust emissions could be kept to a minimum by proper engine maintenance.

Project construction emissions are temporary and would cease upon completion of construction. Impacts to air quality from construction activities are anticipated to be short-term and localized. Although the level of particulate emissions could be significant on an hourly basis, the impact to ambient concentrations is considered insignificant because of the averaging periods (24-hour and one-year). Nitrogen oxide emissions from heavy machinery could conceivably cause an exceedance of the one-hour NO_x state and federal ambient standards. However, given the short-term and temporary nature of the construction activities, the impact to ambient air quality is considered insignificant.

B. Space Launch Vehicle Preparation and Assembly

Processing of the Titan IV PLF at Bldg 8337 will use the materials shown in Table 2.1.2-2. This facility is shared with the Titan II Program. Quantities on this table are shown in units per PLF. One PLF is processed per launch.

The preparation and assembly of the PLF involves several processes that result in the emission of various organic air pollutants. The following paragraphs detail the processes, control equipment, and emissions estimates for each process step. Each PLF is made up of three trisectors, a base, and nose parts, all of which undergo various coating operations prior to assembly.

The surfaces of the trisectors are wiped with methyl ethyl ketone (MEK). The process is repeated three times. Most of the MEK evaporates into the atmosphere.

After cleaning, the trisectors are wiped with Iridite 14-2, an inorganic liquid compound containing hexavalent chromic acid and used to form a conversion coating on aluminum. The contaminated rags used to apply Iridite 14-2 are collected in drums and disposed of in accordance with applicable federal and state regulations.

Two coats of primer are then sprayed onto the trisectors. The primer is carried in an alcohol-naphtha vehicle. Approximately 20 gallons of the primer vehicle are sprayed onto each PLF. In between coatings, each trisector is wiped with MEK. A silicone-based coating is then applied to the trisectors. The application of this coating takes several steps. The first step is the application of the ablative coating. This coating consists of a silicone elastomer base thinned with Freon 113. This task is followed by the application of an organic silicate catalyst coating carried in naphtha and another silicone dispersion coating containing 30 percent naphtha. The silicone enamel (polydimethoxysilane) is then applied after being thinned with Freon 113.

TABLE 2.1.2-2

MATERIALS USED FOR TITAN IV PLF PROCESSING
AT BLDG 8337

Material	Typical Quantity Per PLF (gallons)	Maximum Use Per PLF (gallons)
Freon 113, Pure Compound	175.0	175.0
Ablative Coating, MMS K-799A*	151.7	151.7
Catalyst (Naptha)	7.0	7.0
Dispersion Coating	0.008	0.008
Iridite 14-2	0.25	0.50
Chromic Acid	0.012	0.023
Silicone Enamel, MMS K-797	10.5	10.5
Silver Paint, MMS K-756	5.1	5.1
Primer, MMS K-388	28.0	28.0
Methyl Ethyl Ketone	7.5	7.5
Mineral Spirits	0.5	0.5

* Based on an average density of 35.5 lbs/ft^3

A final coat of a silicone elastomeric base containing 60 percent silver is then applied. Freon 113 is also used to thin the silver silicone base for spray painting. Mineral spirits are used to clean painting equipment.

The operation described above, except for the MEK cleaning, is conducted in two dedicated paint spray booths to be located in Bldg 8337. These booths are equipped with overspray filters and exhaust fans. MEK cleaning is done within Bldg 8337, but outside of the spray booths.

An inventory of organic emissions from a Titan IV PLF preparation and coating operation is presented in Table 2.1.2-3.

TABLE 2.1.2-3

ORGANIC EMISSIONS INVENTORY

Process	Material	Quantity Per PLF gallons	Quantity Per PLF pounds
Surface Cleaning	MEK	7.2	48.2
Primer	Naphtha	19.6	107.8
Ablative Coating	Freon 113	105.6	1383.4
Catalyst Application	Naphtha	5.6	30.8
Silicone Dispersion Coating	Naphtha	neg.	neg.
Silicone Enamel Application	Toluene	3.5	25.0
	Freon 113	6.0	78.6
Silver Silicone Enamel Application	Freon 113	1.74	22.8
Final Wash	Freon 113	18	235.8

Emission rates are based on 100 percent evaporation of the volatile portion of surface coating material.

The maximum organic emissions from the preparation of one PLF for one Titan IV launch is presented in Table 2.1.2-4.

TABLE 2.1.2-4

MAXIMUM ORGANIC EMISSIONS FROM PLF PROCESSING

Organic Material	Emissions Per Launch (tons)
MEK	0.025
Naphtha	0.070
Freon 113	0.860
Toluene	0.015
TOTAL	0.970

Emissions are based on 100 percent evaporation of volatile portion of surface coating material.

Except for toluene, the organic compounds emitted to the atmosphere from PLF processing are nonphotochemically reactive. Toluene is contained in the formulation of the silicone enamel and is not used

separately as a thinner or reducer. (See Section 3.1 for regulatory analysis for emissions of reactive organic compounds).

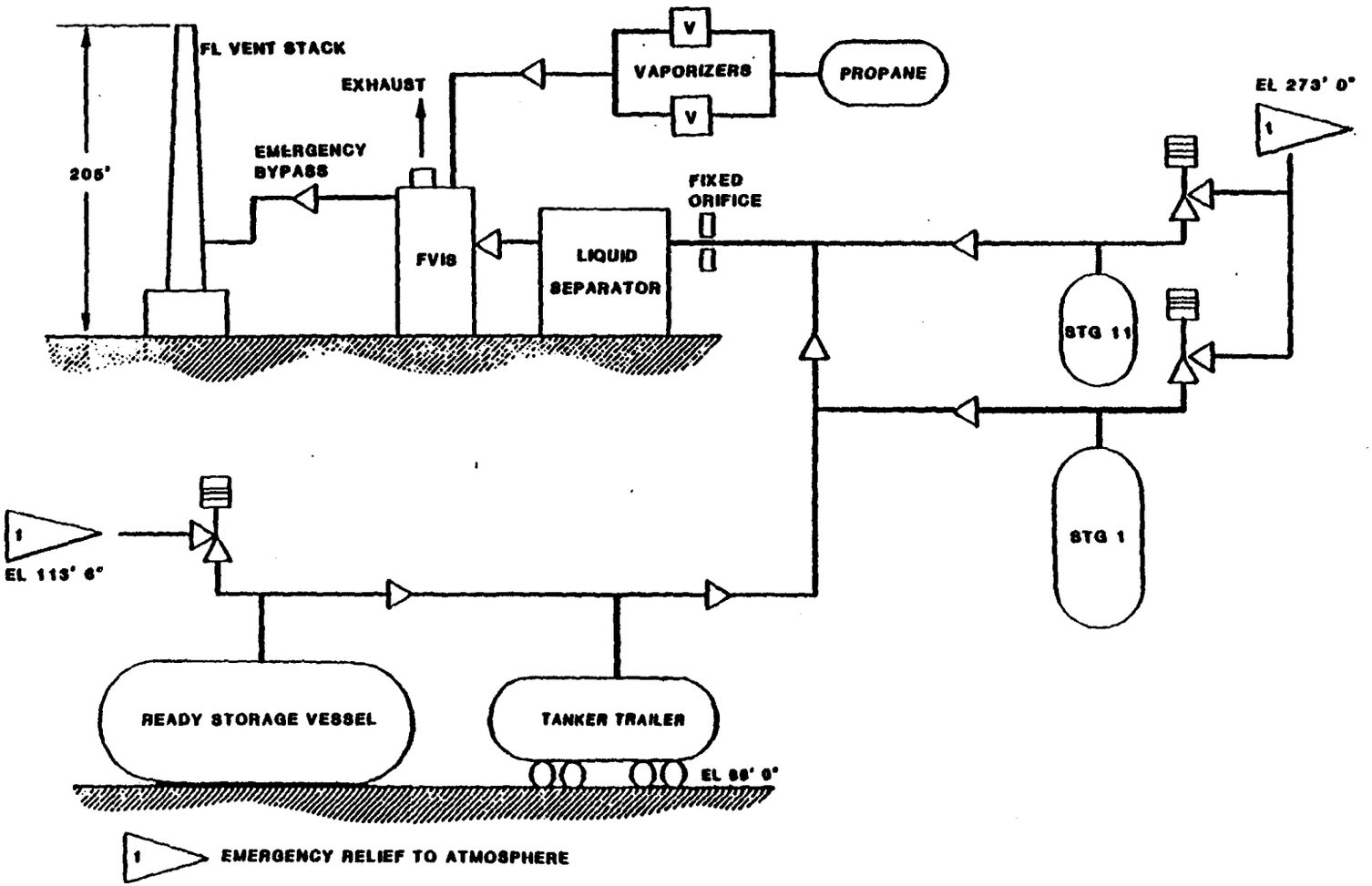
C. Pre-Launch and Post-Launch Processing

Fuel propellant (Aerozine-50) for a Titan IV launch will be delivered and stored at SLC-4E in existing Ready Storage Vessels (RSV). Vapor from the storage and transfer of propellant before and after launch (to RSV from delivery trailer truck, from RSV to Stage I and Stage II fuel tanks, and during post-launch purging of RSV and transfer system) will be vented to a propane-fired fuel vapor incinerator system (FVIS). The FVIS will be used to destroy the propellant vapor prior to release of vapor to the atmosphere. Nitrogen, to be used as the pressurizing medium, will be vented with Aerozine-50 vapor to the FVIS.

A schematic diagram of the FVIS is presented in Figure 2.1.2-2. Similar FVIS equipment is currently in use in deactivation of Titan II ICBMs at various locations throughout the country.

In the past, fuel vapor was vented directly to the atmosphere through a 200-foot tall vent stack, which is permitted by the SBCAPCD. The FVIS will be part of the new operation at SLC-4E. Authority to construct and Permit to Operate permits for the FVIS supporting the Titan IV Program have been submitted to the SBCAPCD.

Small releases of fuel and oxidizer may occur as a result of scheduled post-launch maintenance, when fuel and oxidizer filters are replaced. These releases occur only after the propellant lines have been purged with nitrogen gas to reduce emissions to the lowest practical level. There is no way to completely eliminate these small releases because the system must be opened to change the filters. After the lines are purged, the pressure in the filter vessels is reduced to atmospheric. To estimate emissions during the filter change, the volume of gas was assumed to be that of the filter casing (approximately 1 cubic foot for both fuel and oxidizer filters) and the concentration was assumed to be the same as the concentration during post-loading venting (600,000 ppm for oxidizer and 200,000 ppm for fuel). This concentration is considered to be worst case (Riesbol, 1988). Emissions would amount to 0.05 lb of fuel and 0.10 lb of oxidizer for each filter change.



SOURCE: USAF, 1986a

FIGURE 2.1.2-2
FUEL VAPOR INCINERATOR SYSTEM

These releases are not expected to result in significant adverse impact to the environment.

In the event of an emergency, fuel and oxidizer may vent directly to the atmosphere. Accidental releases could occur during the rupture of part of the propellant loading system. No uncontrolled venting of vapors is expected due to overfilling or overpressurizing of the RSV and the Stage I and II storage vessels. Redundant flow meters and redundant automatic shutdown devices on the propellant loading system prevent overfilling. Automatic pressure monitoring devices on the tanks and feed system prevent overpressurization.

Combustion products consisting of carbon monoxide (CO), sulfur oxides (SO_x), nitrogen oxides (NO_x) and hydrocarbons (HC) are released to the atmosphere through the FVIS fuel vent stack. The FVIS is designed for a maximum Aerozine-50 vapor feed rate of 1.25 lb/min, although normal operation is expected at only 0.0018 lb/min. The emissions from a normal cycle of the FVIS associated with a Titan IV launch cycle (22.5 hours per launch cycle) are presented in Table 2.1.2-5.

TABLE 2.1.2-5

EMISSIONS FROM FUEL VAPOR
INCINERATOR SYSTEM FOR A TITAN IV LAUNCH CYCLE

Fuel Incinerated	Pollutant Emitted	Emission Rate	
		lb/hr	lb/launch cycle
Aerozine-50	HC	0.025	0.56
vapor (90%	NO_x	1.7	38.25
UDMH, 10%	SO_x	0.0012	0.03
N_2H_4)	CO	1.35	30.38

Source: SBCAPCD Permit Application.

Average hourly emissions from performance tests for VAFB operations are presented in Table 2.1.2-6.

TABLE 2.1.2-6

AVERAGE RATE OF EMISSIONS FROM THE FUEL VAPOR INCINERATOR SYSTEM

Pollutant	Emission Rate (lb/hr)
NO_x	1.70
HC	0.03
CO	1.35
UDMH	below UDMH detection limit of 2.2×10^{-6} lb/min
Hydrazine	below N_2H_4 detection limit of 1.1×10^{-5} lb/min
NDMA (Nitrosamine)	below NDMA detection limit of 2.0×10^{-8} lb/min

Source: SBCAPCD Permit Application.

Oxidizer (N_2O_4) vapor from trailer off-loading and Titan IV core tank post-loading is vented to an existing propane-fired oxidizer vapor burner for disposal. This burner is rated for a maximum loading of 10 lb/min of N_2O_4. Performance tests on similar burners were conducted in 1981 by the Martin Marietta Corporation (MMC). An analysis of these tests contained in a survey of emissions at VAFB (USAF, 1983b) suggest that a 90 percent efficiency factor be used in estimating emissions from the oxidizer vapor burner. The proportion of NO to NO_2 will be based on the results of the performance tests (approximately 3:1). Emission rates for the oxidizer vapor burner as estimated from feed data provided by MMC are presented in Table 2.1.2-7.

The Titan IV payload could be propelled with either N_2H_4 or a combination of N_2O_4 and MMH. Vapors from the Titan IV payload propulsion system loading will be vented to the N_2O_4 vapor burner or fuel vapor incinerator, as appropriate. The amount of propellant to be

TABLE 2.1.2-7

OXIDIZER VAPOR BURNER EMISSION RATES

Vapor Rate[a]	Pollutant	Emission Rate lb/hr	Emission Rate tons/launch cycle	Emission Rate maximum tons/yr
10 lb/min (600,000 ppm N_2O_4)	NO	414	0.62	1.25
	NO_2	210	0.32	0.63
	N_2O_4	60	0.09	0.18

[a] Source: ES, 1986d.

vented to the scrubber per Titan IV launch is designed not to exceed 50 lbs of N_2O_4, 50 lbs of MMH, and 10 lbs of N_2H_2.

An accidental propellant spill may also be a source of emissions and particular attention is given to the potential toxicity problems related to propellant strength. Previous USAF studies were directed toward assuring a safe range of operation.

If the direction of the wind, as reported in the THC forecast, and the critical distance for hazardous vapor dispersal were to include an onbase or offbase uncontrolled area, propellant loading would be postponed. Personnel involved in the propellant transfer will be provided with protective clothing and breathing equipment. Personnel not involved in the transfer operation will be restricted from the area.

Impacts to air quality from fuel and oxidizer vapor emissions are considered insignificant because emission levels are low, the occurrence of emissions is infrequent, and operations are intermittent.

D. Launch Emissions

Launch operations constitute the largest source of uncontrollable emissions into the atmosphere. Emissions from a Titan IV launch are associated with the oxidation of various propellants during various stages of the launch cycle. The combustion products are distributed along the trajectory of the launch from lift-off to shutdown of Stage II.

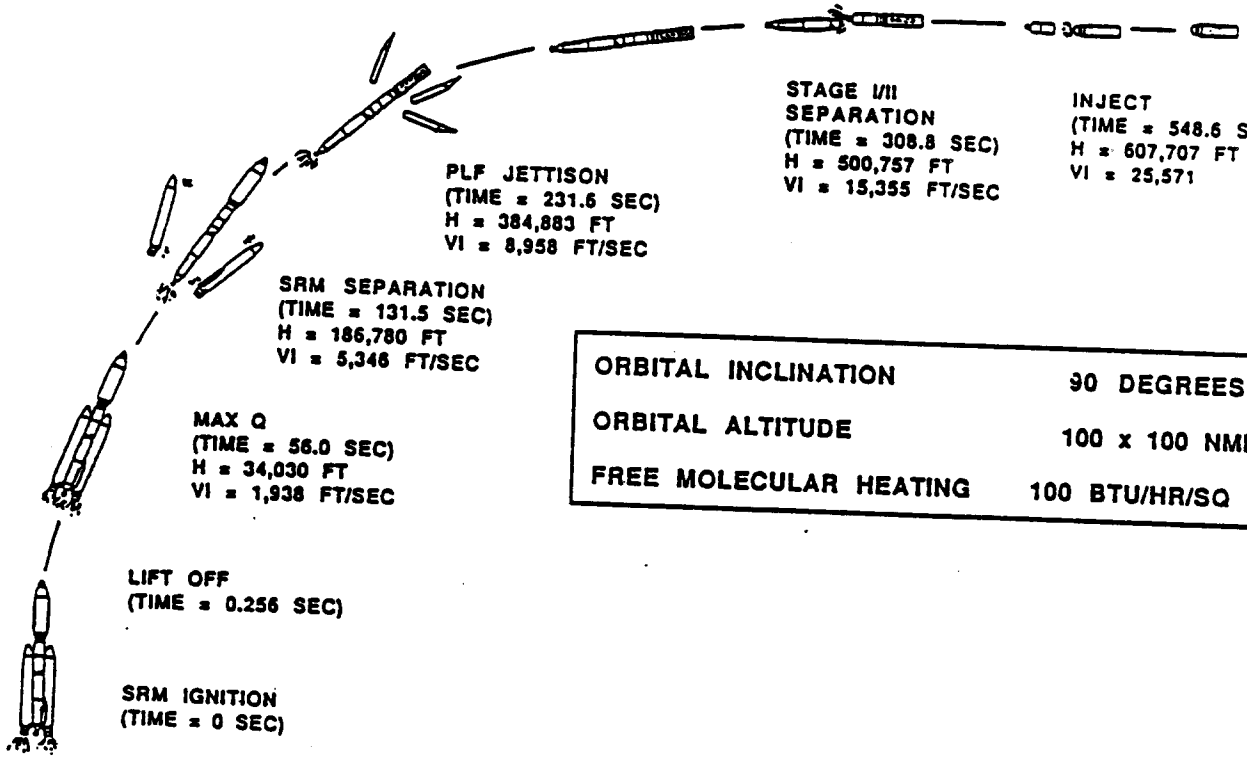
At lift-off, the SRMs are ignited. The solid propellant in the SRMs is made up of various chemicals that include aluminum, acrylonitrite, ammonium perchlorate, polybutadiene-acrylic acid, and nitrogen tetroxide. The products of combustion at the engine nozzle exit plane for the SRMs and their corresponding weight fractions are presented in Table 2.1.2-8. It is expected that at altitudes less than 125,000 ft, only HCl, CO_2, N_2 and Al_2O_3 would be detectable in significant quantities because of instability of molecular fragments. CO would be converted rapidly to CO_2 due to the initial high combustion temperature and the abundance of oxygen in the surrounding atmosphere. Of these combustion products, HCl and Al_2O_3 are considered as pollutants, HCl being toxic and Al_2O_3 occurring as nuisance particulate matter. Emissions during a Titan IV launch would be distributed along the trajectory of the launch vehicle. Figure 2.1.2-3 shows the trajectory profile for a Titan IV vehicle. The SRMs burn for approximately 2.2 minutes at which point the vehicle is at an altitude of 35 miles. At this point, the SRMs separate from the core vehicle and Stage I is ignited. Stage I burns for approximately 3 minutes, followed by Stage I/Stage II separation at an altitude of 95 miles at which time Stage II is ignited to place the payload in orbit.

TABLE 2.1.2-8

PRODUCTS OF COMBUSTION AT ENGINE NOZZLE EXIT PLANE FOR TITAN IV SOLID ROCKET MOTORS

Product of Combustion	Weight Fraction
H^+	0.0002
C^-	0.0022
CH^-	0.0002
HCl	0.2055
H_2O	0.0711
H_2	0.0244
CO	0.2755
CO_2	0.0248
N_2	0.0827
$AlCl_3$	0.0089
Al_2O_3	0.3010

Source: USAF, 1975



ORBITAL INCLINATION	90 DEGREES
ORBITAL ALTITUDE	100 x 100 NMI
FREE MOLECULAR HEATING	100 BTU/HR/SQ FT

FIGURE 2.1.2-3
TITAN IV SLV LAUNCH SCENARIO

The propellants used for Stage 1 and Stage 2 of the Titan IV space booster are the same as those used for other Titan space boosters and consist of Aerozine-50 and N_2O_4. N_2O_4 is also used for the thrust vector control system on the SRM. The propellant combustion products for Titan IV do not differ from the other Titan space boosters in terms of chemical species and their corresponding weight fractions. These combustion products are presented in Table 2.1.2-9.

TABLE 2.1.2-9

PRODUCTS OF COMBUSTION AT NOZZLE EXIT PLANE FOR TITAN IV STAGE 1 AND STAGE 2 ENGINES

Product of Combustion	Weight Fraction
CO	0.025
CO_2	0.181
H_2	0.002
H_2O	0.350
OH	0.004
O_2	0.007
N_2	0.411
NO_x	0.019

Source: USAF, 1975

Of these combustion products, only carbon monoxide (CO) and nitrogen oxides are identified as air pollutants.

Total emissions from a Titan IV launch are presented in Table 2.1.2-10. These values were estimated using emission factors for a Titan IIID launch contained in Table 2.29 of the VAFB Emission Survey (USAF, 1983b). The emission factors represent estimated quantities of pollutants released below 5,000 ft altitude per launch and therefore, represent only emissions from the SRMs. CO emissions were estimated using the CO weight fractions in the combustion streams presented in Tables 2.1.2-8 and 2.1.2-9 and corresponding solid and liquid propellant quantities. This was further reduced by using the proportion of CO emissions released below 5,000 ft to the total CO emissions.

TABLE 2.1.2-10

TITAN IV AIR POLLUTANT EMISSIONS
FROM SRMs

Pollutant	Tons Per Launch
HCl	27.2
Al_2O_3	40.8
CO	37.7
NO_x	0.7

Dispersion of these pollutants in the ground cloud, the exhaust plume that persists at the launch pad area during ignition and lift-off, has been extensively studied to determine if cloud growth through diffusion would cause the exposure of civilian population, as well as other sensitive receptors, to harmful concentration levels. These studies were accomplished to support the use of SRMs as propellants. A diffusion analysis was presented for the Titan IIIC and Titan IIID programs in the Final Environmental Statement (FES) for U.S. Air Force Space Launch Vehicles (USAF, 1975) and will be the basis of analysis in this document.

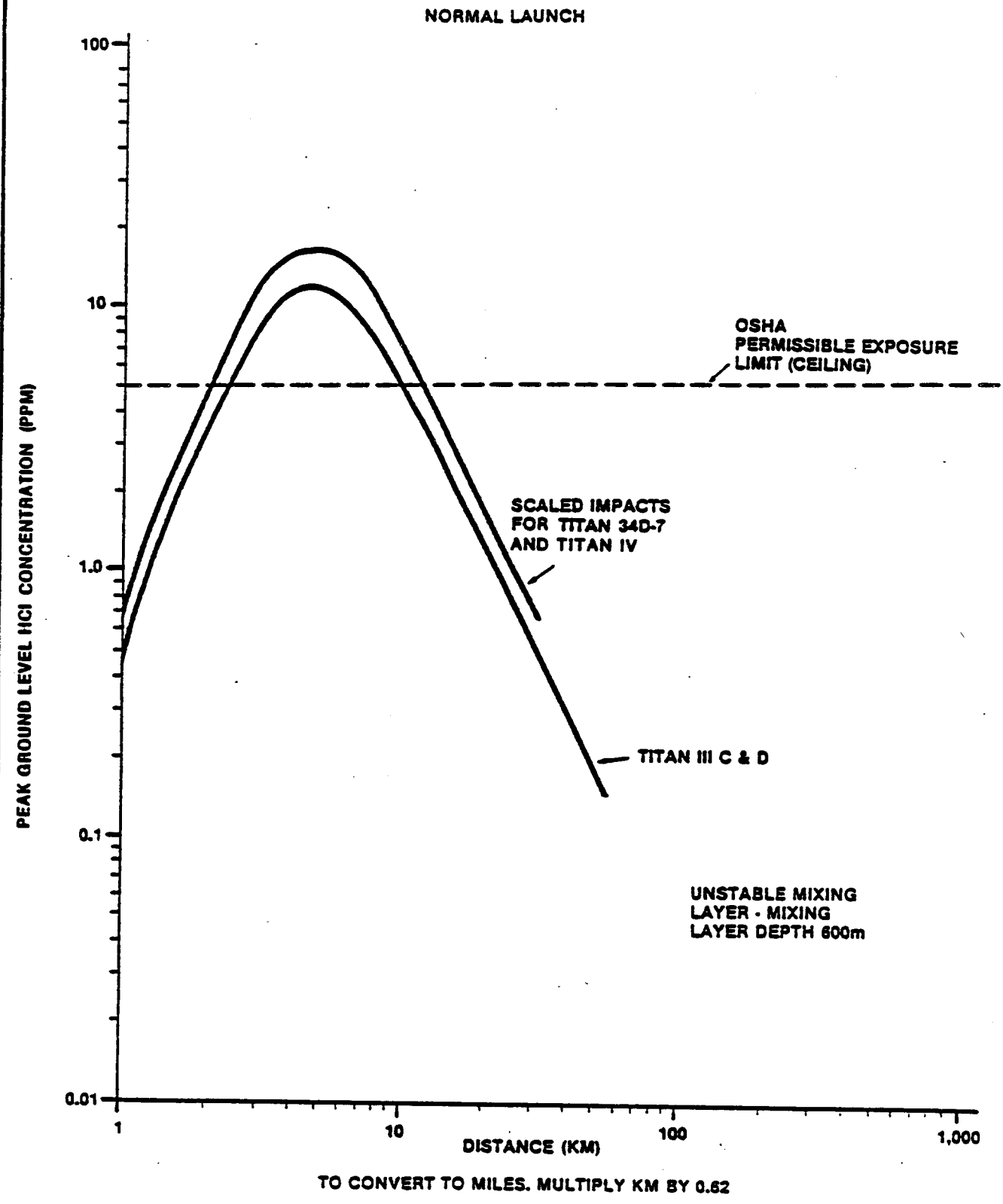
In the 1975 FES, profiles of peak ground level concentrations of HCl and Al_2O_3, as well as CO (which was treated as if it did not oxidize to CO_2), were presented as a function of distance from the launch pad area. These profiles were prepared using typical weather parameters and expected performance and trajectories of the vehicles. The diffusion model used to calculate peak ground level concentrations assumed an instantaneous elevated volume source. The vertical distribution of the exhaust products was initially assumed to be Gaussian about the actual stabilized height of the exhaust ground cloud. The model required that an effective source height for the HCl be determined within the surface mixing layer. A spherical cloud with a trivariate Gaussian distribution of the material within the mixing layer was assumed to be centered at the effective height.

As shown in Figures 2.1.2-4 and 2.1.2-5, peak ground level concentrations of HCl and Al_2O_3 were predicted to be 11 ppm and 28 mg/m^3, respectively, at a distance of approximately five kilometers (3.1 miles) downwind of the launch pad for a Titan IIIC/D launch. The peak concentration would be present for only two to 15 minutes in any location depending on wind conditions.

The Titan 34D7 program and its environmental impacts were described in the Environmental Assessment for Complementary Expendable Launch Vehicle at Cape Canaveral Air Force Station (USAF, 1986a). The diffusion analysis for the ground cloud was based on the 1975 FES. Peak ground level concentrations for a Titan 34D7 launch were estimated by prorating the predicted peak ground level concentration for Titan IIIC/D launches using the ratio of SRM propellant quantities as a multiplier. The profiles, also shown on Figures 2.1.2-4 and 2.1.2-5, were drawn using the Titan IIIC/D profiles and the scaled increment. Peak ground level concentrations of HCl and Al_2O_3 were predicted to be 18 ppm and 38 mg/m^3, respectively.

The Titan IV launch vehicle will use similar SRMs (approximately the same quantity of propellant and similar configuration of seven segments) as the Titan 34D7 launch vehicle. Based on this, the peak ground level concentrations and profiles for HCl and Al_2O_3 predicted for a Titan 34D7 launch are assumed to represent a Titan IV launch as well. The vertical variation, however, may be different depending on the weight of the payload and the launch trajectory.

Because the separation distance between the launch area and uncontrolled areas at VAFB is only about 6.5 kilometers (4 miles) inland, the potential for exposure of civilian population to elevated levels of HCl and Al_2O_3 exists. Ground cloud measurements for HCl concentrations during a Titan IIID launch at VAFB and at the United Technology Corporation, Coyote Pass Facility, located near San Jose, California during a test firing of a seven segment SRM have yielded data that were approximately half of the levels predicted by the diffusion model. Predicted and measured HCl concentrations for the Titan IIID launch at VAFB were 20.5 ppm and 9.66 ppm, respectively. At the Coyote Pass testing facility, the predicted HCl concentration was 23 ppm and



SOURCE: USAF, 1986

FIGURE 2.1.2-4

PREDICTED GROUND LEVEL HCl CONCENTRATION PROFILE AS A FUNCTION OF DISTANCE FROM LAUNCH SITE

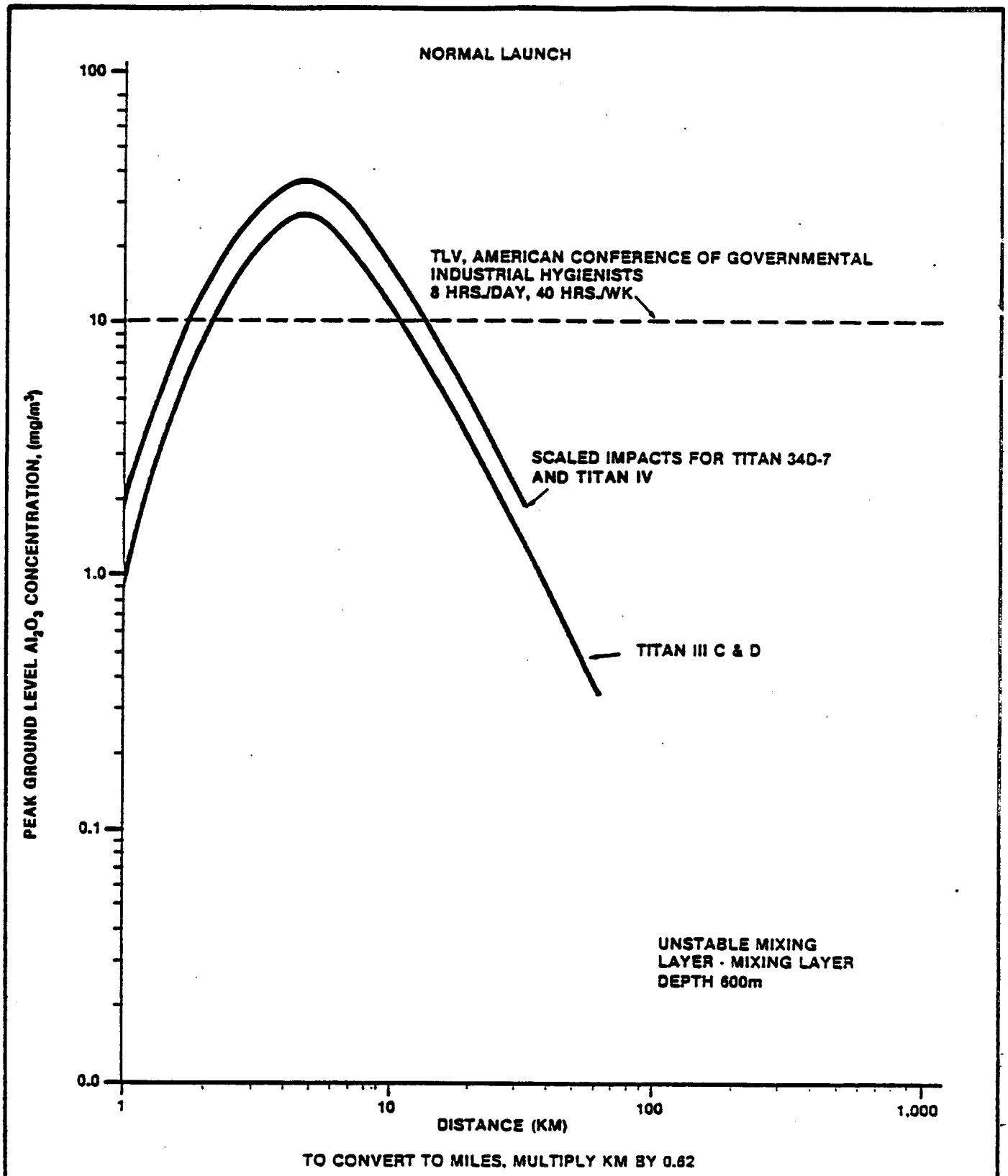


FIGURE 2.1.2-5

PREDICTED GROUND LEVEL Al_2O_3 CONCENTRATION PROFILE AS A FUNCTION OF DISTANCE FROM LAUNCH SITE

SOURCE: USAF, 1986

the measured value was 10.6 ppm. The maximum Al_2O_3 ground level concentration recorded for Titan SRM testing at the Rocket Propulsion Laboratory at Edwards Air Force Base, California was 31.3 ug/m^3 at a distance of 7.5 miles downwind (USAF, 1986f).

The Occupational Safety and Health Administration (OSHA) defines the permissible exposure limit (PEL) of hydrogen chloride at 5 ppm. The American Conference of Governmental Industrial Hygienists (ACGIH) has adopted a similar standard called the threshold limit value (TLV) which is also 5 ppm for HCl. Both the PEL and the TLV for HCl are ceiling limits, which is defined as the "maximum concentration that should not be exceeded during any part of the working exposure." Exposure to HCl from a Titan IV launch is short-term and short-term exposure limits (STEL) for HCl have not yet been defined by either OSHA or ACGIH. Impacts could be significant if a launch occurred during unfavorable meteorological conditions such as onshore (from the west) wind flows. The THC forecast would provide necessary information to determine favorable launch conditions. Launching during favorable meteorological conditions would result in minimal impacts whereupon exposure to HCl above the PEL would be of very short duration and away from civilian population.

As previously stated, Al_2O_3 generated from a Titan IV launch, occurs as particulate matter and can be considered as nuisance dust. The ACGIH TLV for nuisance dust is 10 mg/m^3 which is a time-weighted average (TWA) for a normal 8-hour workday and a 40-hour workweek. Unlike the ceiling limit, the TLV-TWA can tolerate excursions of up to three times the TLV for 30 minutes, with a maximum excursion of five times the TLV, provided the TLV-TWA is not exceeded. Al_2O_3 dust concentrations immediately after a Titan IV launch would be expected to exceed the TLV-TWA. However, since this occurrence is short-term, the time-weighted average Al_2O_3 concentration level would be less than the TLV and therefore, poses no significant impact.

Nitrogen oxides are formed much later in the trajectory of the space vehicle. The impact of the dissociation of NO_x on the ozone layer has been previously analyzed by comparing the effect of emissions from supersonic jets to that from Titan launches (USAF, 1975). Because the

operation of a supersonic transport fleet was judged to be safe in terms of the effect of NO_x on the ozone layer (see summary of findings published by the Massachusetts Institute of Technology, Reference No. 43 in USAF, 1975), it was concluded that the Titan launches would be no different. NO_x concentrations will dissipate rapidly below the natural ground-level concentration well before they reach the ground.

E. Emissions from Vehicle Failures

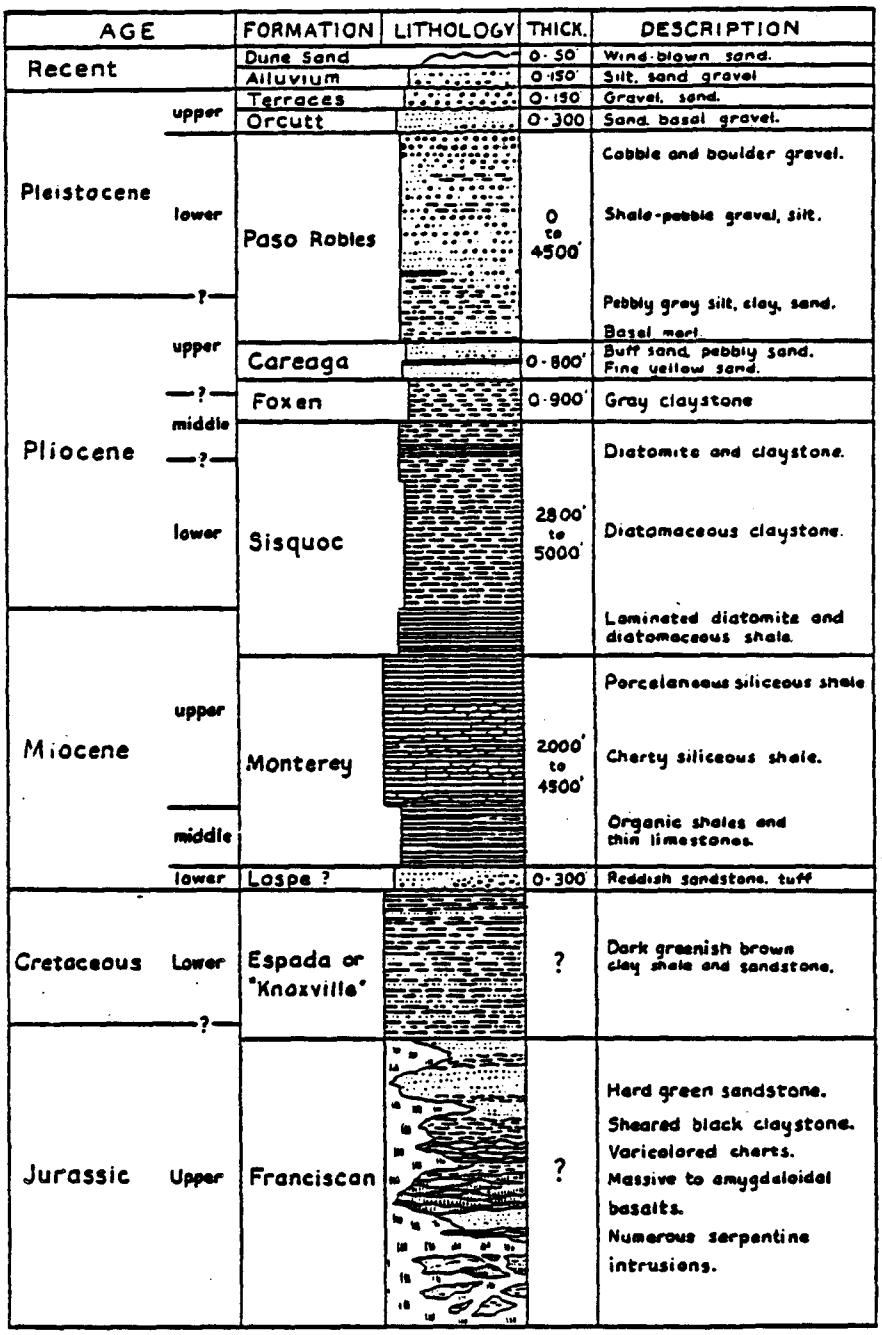
Launch failures can result in the emission of air pollutants. These accidents include vehicle destruction on the pad, an in-flight failure, and commanded vehicle destruction. In the event that the liquid propellant tanks ruptured and the vehicle destruct system were activated, most of the propellant would immediately ignite and burn due to its hypergolic nature.

The air pollutants generated from a vehicle failure would be chemically similar to those produced during a normal launch, but in undetermined quantities and concentrations. Resultant ambient nitrogen oxide concentrations would depend on the type of accident. Except during a launch pad accident, nitrogen oxides would be generated at a vertical distance from the pad and dilution would have occurred prior to detection at ground level. Launch pad accidents, however, might increase ambient nitrogen oxide concentrations. Adherence to the THC forecast would ensure minimized migration of pollutants into uncontrolled areas near VAFB.

2.1.3 GEOLOGY AND SOILS

2.1.3.1 Stratigraphy

The stratigraphy of the SLC-4E area is summarized in Figure 2.1.3-1. SLC-4E and its associated support facility sites are underlain by exposures of the Pleistocene nonmarine Orcutt Sand (Dibblee, 1950). This unit, up to 300 feet thick, consists primarily of unconsolidated wind-blown sand. Locally, the top of the unit is consolidated. The base of the unit is a gravel. Impacts to the Orcutt Sand will not be significant because exposures for which the unit was named will not be impacted.



SOURCE: Dibblee, 1950

FIGURE 2.1.3-1

STRATIGRAPHIC COLUMN

2.1.3.2 Paleontologic Resources

The Orcutt Sand has yielded only a few remains of freshwater mollusks in the Purisima Hills and remains of a tapir (land mammal) in the Casmalia Hills (ES, 1987; USAF, 1977a; Woodring and Bramlette, 1950). No significant fossil remains have been reported from the immediate vicinity of the project sites. The Orcutt Sand is considered to be only of low paleontologic importance because of its low potential for yielding any fossil remains in this area. For this reason, no significant impact to paleontologic resources is expected during project construction or operation.

2.1.3.3 Soils

SLC-4E and associated project sites on South VAFB are underlain by soils of the Marina-Oceano association, which consists of nearly level to moderately steep, excessively drained sand normally found on mesas and dunes (U.S. Soil Conservation Service, 1972). Project sites on North VAFB are underlain by soils of the Tangair-Narlon association, which consists of nearly level to strongly sloping, somewhat poorly drained and moderately well drained sand and loamy sand on terraces.

Impacts

Adverse impacts to soils within the project sites will not be significant because they have previously been affected by ground-disturbing activities.

Erosion could occur in new construction areas and result in the loss of soil. However, any erosion is expected to be of minor significance because erosion control measures, as specified in the Base Land Management Plan, will be conducted.

Soils could be contaminated by a spill of fuel, lubricant, solvent, or contaminated runoff during construction or operation. Operational personnel will adhere to the VAFB Spill Prevention, Control, and Countermeasure (SPCC) Plan. Any occurrence of soil contamination is expected to be very localized. There will be no significant adverse impact to soil productivity as a result of the project.

Operation of the project may have an impact on soils within and surrounding SLC-4E. During a launch, soils near SLC-4E will be subject to severe thermal and chemical stresses from hot exhaust discharges from the flame trenches, formation of a ground cloud, and possible accidental contamination by exhaust-derived chemicals in deluge water being discharged beyond the immediate pad location. However, these impacts will not reduce the utility of the soils. Moreover, these are not new impacts but rather a continuation of those resulting from ongoing activities at SLC-4E. Launch facilities are designed to retain all deluge water.

Impacts to soils from a toxic chemical or fuel spill, though potentially more significant than contamination from a launch, would affect only a limited area. Propellant tanks at SLC-4E are bermed and overflow would drain into the retention basin. Therefore, a spill would not impact soils.

Impacts to soils from a launch-related wildfire might be greater than those associated with a large spill. An intense fire, particularly one resulting from an explosion, could make a large area susceptible to erosion and cause extensive loss of soil and fertility. Although a large wildfire could have a significant impact, its potential for occurring from launch-related operations at SLC-4E is low. VAFB has fire control personnel ready to respond to a launch-induced fire. Wildfires are a normal occurrence in this type of coastal vegetative community. The impacts from a launch-induced wildfire would be the same as other wildfires.

2.1.3.4 Geologic Hazards

A. Seismicity

The seismic history and potential of the project vicinity has been summarized by the USAF (1977a, 1978) and Arthur D. Little, Inc. (1985). A major earthquake is recorded in the Santa Barbara County area every 15 to 20 years. During the last 200 years, several major earthquakes have resulted in extensive damage to structures, but no damage has been recorded in the history of VAFB. Although no active fault lies within the project sites, numerous active and potentially active late

Quaternary faults occur nearby. These faults are portrayed in Figure 2.1.3-2, as are epicenters for earthquakes with a magnitude (Richter Scale) of 4 or greater. Available data suggest continuing moderate earthquake activity with the potential for a major earthquake within the region.

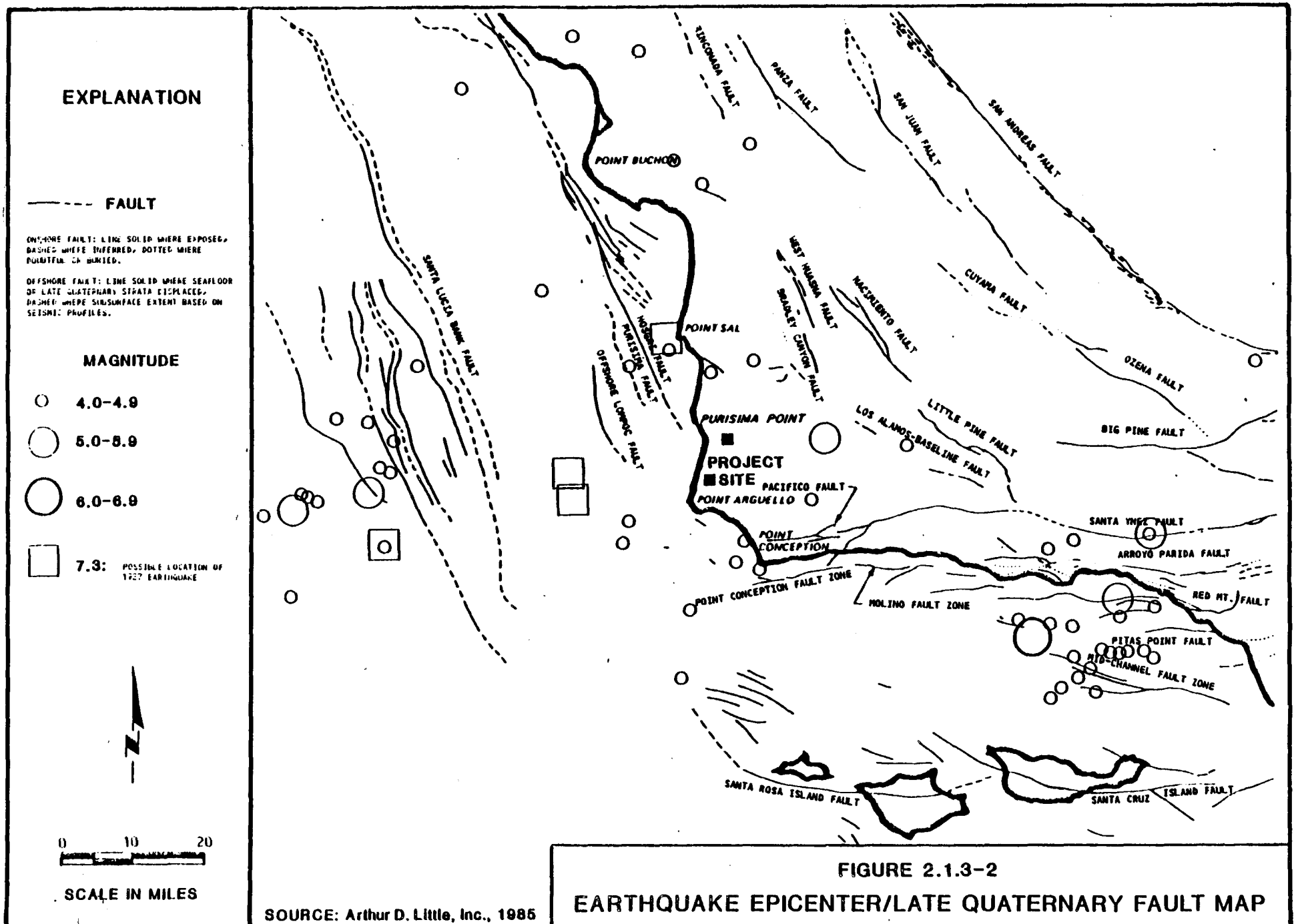
Numerous active onshore faults (evidence of movement within last 11,000 years) are within the vicinity of VAFB and include the Big Pine, Big Pine Extension, Graveyard-Turkey Trap, Los Alamos-Baseline, Mesa, More Ranch, Nacimiento, Pacifico, Santa Cruz Island, Santa Rosa Island, San Andreas, and Santa Ynez Faults. The nearest is the Pacifico Fault, which lies about 15 miles southeast of SLC-4E. Active faults are also located on the continental shelf offshore of VAFB. Among these are the Hosgri, Molino, Offshore Lompoc, Point Conception, and Santa Lucia Bank Faults, as well as some unnamed faults on Santa Lucia Bank. The Hosgri Fault, which may have produced the 1927 7.3-magnitude Lompoc earthquake and could yield a magnitude-8 earthquake (Gawthrop, 1978), lies just off the coast at Point Sal and may lie within 10 miles of SLC-4E.

Potentially active onshore faults (evidence of movement between 11,000 and 500,000 years ago) in the area include the Arroyo Parida-Santa Anita, Bradley Canyon, Cuyama, Rinconada, San Jose, and Santa Maria River-Foxen Canyon-Little Pine Faults. Potentially active offshore faults include the Offshore Purisima Fault.

Inactive faults (no evidence of movement in last 500,000 years) include the Carneros, Camuesa, Hildreth, Honda, Lion's Head, Lompoc Terrace, and San Antonio Faults. The Honda Fault lies only 1.8 mile south of SLC-4E.

Impacts

Damage from seismic activity results primarily from groundshaking. The project sites are within a zone where an earthquake of intensity VII to VIII on the Modified Mercalli Intensity Scale could occur. Damage from groundshaking resulting from an earthquake of these intensities would range from negligible to great in specially and poorly designed structures, respectively. Groundshaking could also cause liquefaction and landsliding, which are discussed below. Groundshaking from a major



SOURCE: Arthur D. Little, Inc., 1985

FIGURE 2.1.3-2

EARTHQUAKE EPICENTER/LATE QUATERNARY FAULT MAP

seismic event near the project sites could have significant impacts on project facilities and operations. However, project facilities are designed and built to withstand a moderate earthquake.

B. Liquefaction

Liquefaction occurs when a saturated granular soil loses its shear resistance and flows as a viscous fluid. Liquefaction can be induced by an earthquake and result in the destruction of a structure built on the soil that fails. In the vicinity of the project sites, soils potentially subject to liquefaction occur along beaches, river mouths, estuaries, and in areas below the water table (USAF, 1977a, 1978). However, the project sites lie at elevations above 100 feet and no significant impacts from liquefaction are expected.

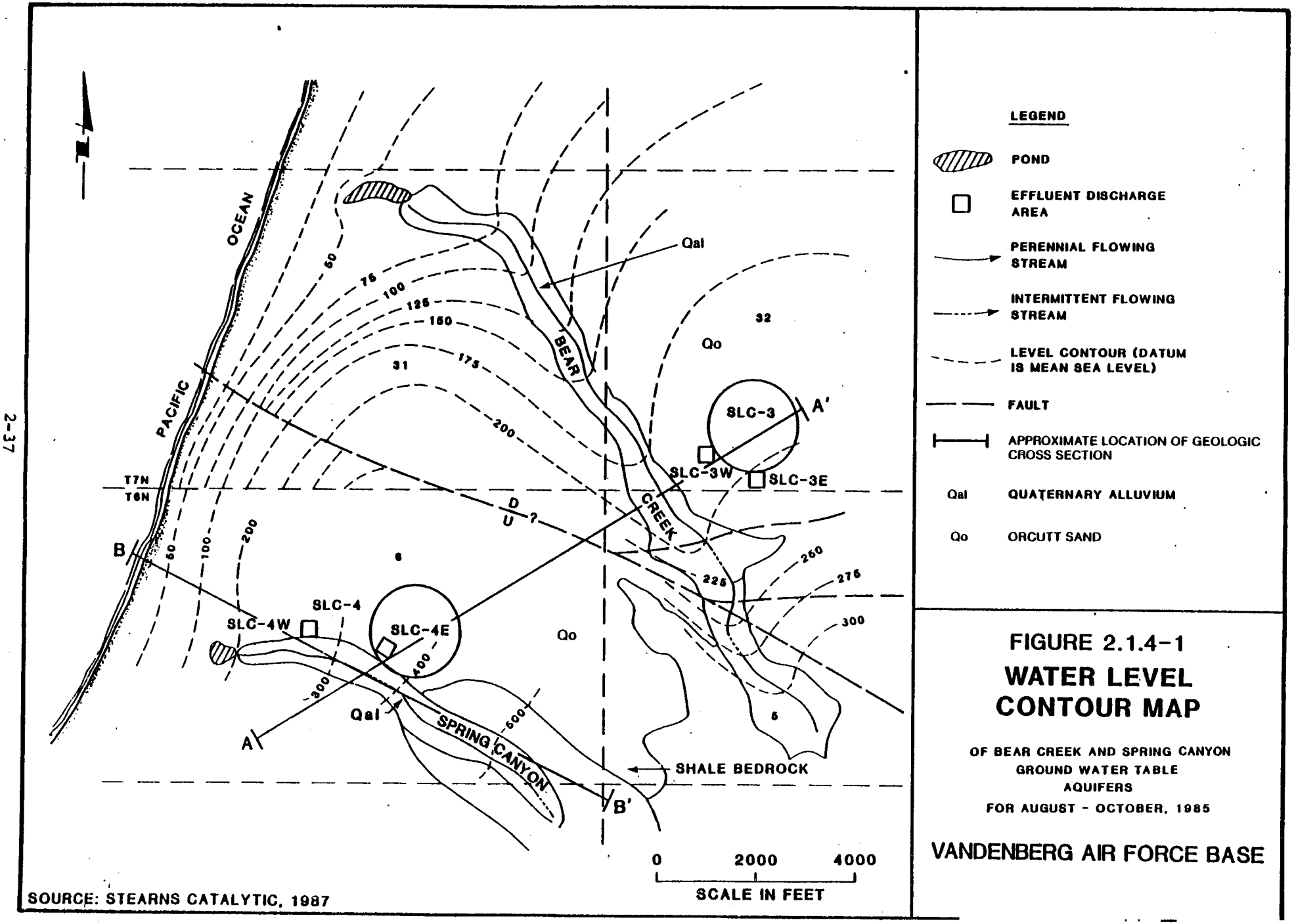
C. Soil Creep and Landslides

Soil creep and landsliding are the perceptible downslope movement of a relatively dry mass of soil and/or rock. The potential for landsliding is influenced by slope, underlying rock structure, degree of saturation, and the type and extent of vegetative cover. A landslide can be triggered by an earthquake. Soil creep affects only surficial soil, particularly soil that is clay rich. These downslope movements have damaged structures in Santa Barbara County. However, the formations that are considered most susceptible to these phenomena (USAF, 1977a) are not exposed within the project sites and no significant impacts are expected.

2.1.4 HYDROLOGY

2.1.4.1 Groundwater

Groundwater resources of the project vicinity are described by the USAF (1977a, 1978) and Stearns Catalytic (1987). Groundwater is restricted to the shallow surficial sedimentary deposits of the Orcutt Sand, which underliss most of the SLC-4 area, and the overlying Quaternary (Holocene) alluvium, which fills the bottom of Spring Canyon (Figures 2.1.4-1, 2.1.4-2, and 2.1.4-3).

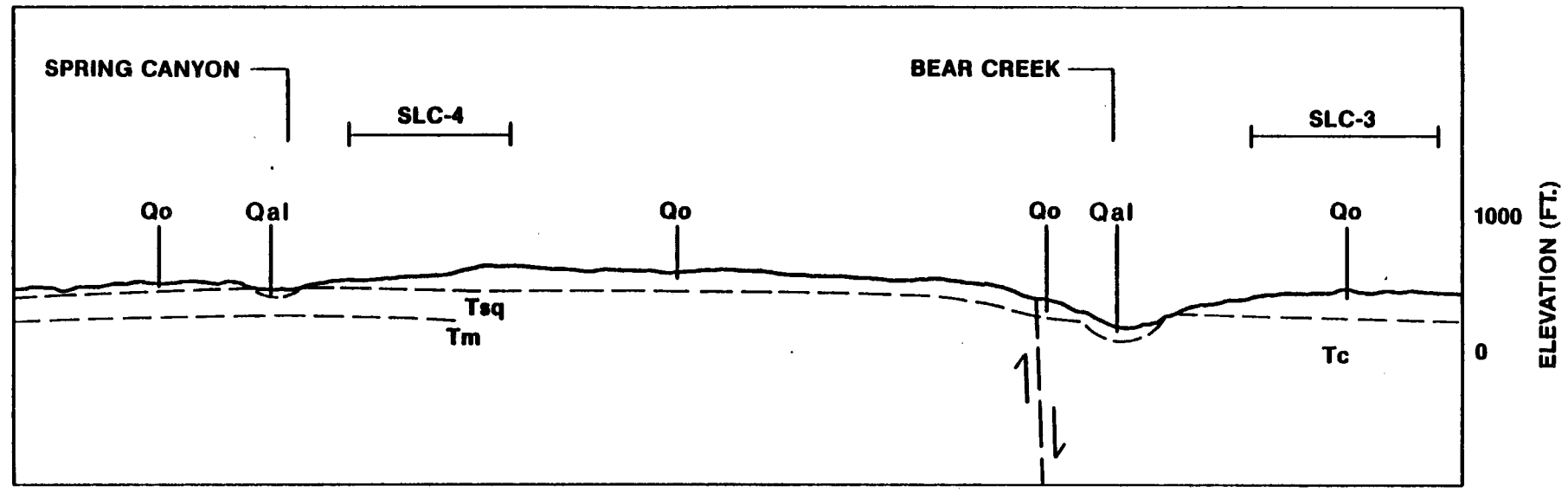


SOURCE: STEARNS CATALYTIC, 1987

FIGURE 2.1.4-1
WATER LEVEL CONTOUR MAP

OF BEAR CREEK AND SPRING CANYON
GROUND WATER TABLE
AQUIFERS
FOR AUGUST - OCTOBER, 1985

VANDENBERG AIR FORCE BASE

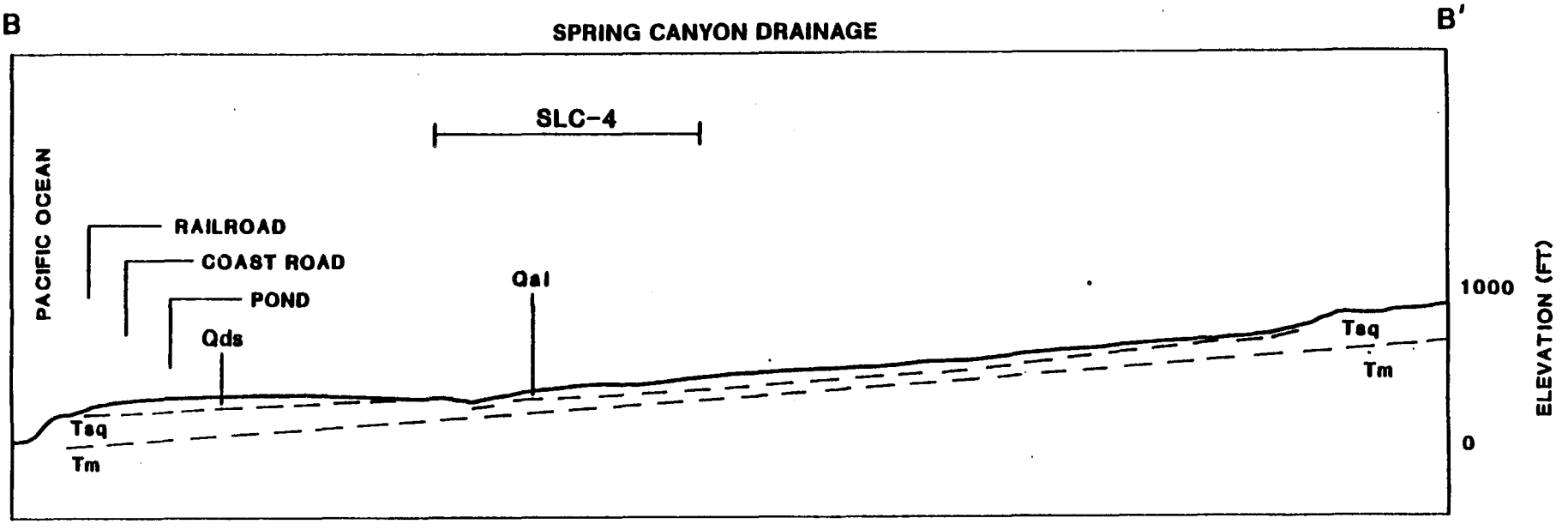


LEGEND

Qal	YOUNGER ALLUVIUM - GRAVEL, SAND, AND CLAY UNDERLYING ALLUVIAL PLAINS.
Qo	ORCUTT SAND - NONMARINE SAND, CLAY, AND MINOR GRAVEL; YIELDS WATER TO WELLS, BUT IS GENERALLY OF LOW PERMEABILITY.
Tc	CAREAGA SAND - MARINE SAND AND MINOR GRAVEL, UNCONSOLIDATED BELOW ZONE OF SATURATION.
Tsq	SISQUOC FORMATION - DIATOMITE AND DIATOMACEOUS CLAY SHALE; DOES NOT YIELD WATER TO WELLS.
Tm	MONTEREY FORMATION - SILICEOUS AND DIATOMACEOUS SHALES; CONTAINS SOME WATER IN FRACTURES.
	FAULT - ARROW INDICATES RELATIVE MOTION.
SCALE	HORIZONTAL = VERTICAL

SOURCE: STEARNS CATALYTIC, 1987

FIGURE 2.1.4-2
GEOLOGIC CROSS SECTION OF THE SLC-3 AND SLC-4 AREAS



LEGEND

Qds	DUNE SAND - LOOSE, WIND-DEPOSITED SAND ALONG COAST.
Qal	YOUNGER ALLUVIUM-GRAVEL, SAND, AND CLAY UNDERLYING ALLUVIAL PLAINS.
Tsq	SISQUOC FORMATION-DIATOMITE AND DIATOMACEOUS CLAY SHALE; DOES NOT YIELD WATER TO WELLS.
Tm	MONTEREY FORMATION-SILICEOUS AND DIATOMACEOUS SHALES; CONTAINS SOME WATER IN FRACTURES
	EFFLUENT DISCHARGE CHANNEL FROM SLC-4
SCALE	HORIZONTAL = VERTICAL

SOURCE: STEARNS CATALYTIC, 1987

FIGURE 2.1.4-3

GEOLOGIC CROSS SECTION OF THE SPRING CANYON DRAINAGE AREA

The Orcutt Sand, which underlies most of the Lompoc Terrace, consists primarily of unconsolidated sand that can hold a relatively large amount of water. However, many of the lenses within the formation contain silt and clay that probably prevent the Orcutt Sand from rapidly transmitting or yielding large amounts of water.

Groundwater in Spring Canyon is restricted to the Quaternary (Holocene) alluvium, which is composed of unconsolidated deposits of gravel, sand, silt, and clay. The water table is relatively deep (20 and 140 feet) in both the upper and lower reaches, respectively, of Spring Canyon. The middle reaches have shallower stream gradients, which suggest a shallow dip for the contact between the alluvium and underlying shale bedrock. Here the water table is at a depth of only about 10 feet.

The underlying Sisquoc and Monterey Formations are comparatively consolidated and not water bearing, except for fractures and local beds of sand. Approximately one-half of the Spring Canyon drainage contains exposed bedrock, which limits infiltration and increases runoff during a precipitation event.

In general the Spring Canyon aquifer is at much higher elevations than the aquifers to the north. Therefore, SLC-4 appears to be isolated from the groundwater system in Bear Creek Canyon. Predominant groundwater flow is toward the Pacific Ocean, as shown in Figure 2.1.4-1. This information indicates that the SLC-4E effluent discharge that percolates into the Spring Canyon groundwater system will flow to the ocean. The rate of groundwater flow has not been determined.

Impacts

Impacts to groundwater resources by construction within the project sites will not be significant because there will be no major ground-disturbing activity in any previously undisturbed area.

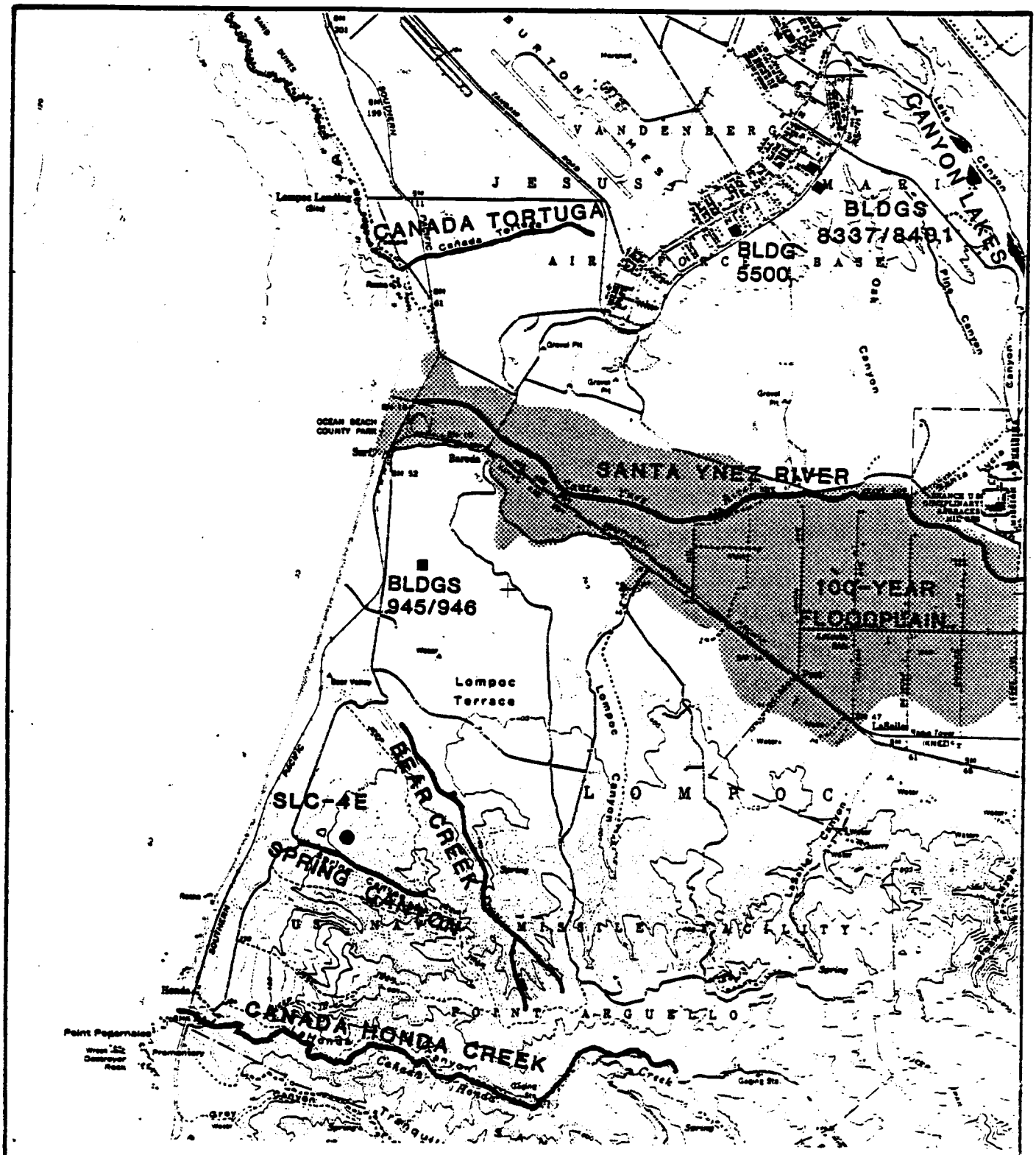
The continued operation of SLC-4E will impact groundwater hydrology in two ways. The first impact will result when groundwater is pumped from two wells in the Lompoc Terrace aquifer to supply the South VAFB water system. This system supplies all water needs for SLC-4E, including deluge water. An increase of 50,000 gallons in deluge water

requirements from the 120,000 gallons per launch for the Titan 34D program to 170,000 gallons (0.368 acre feet) for the Titan IV program (MMC, 1986d; Pergler, 1988b) is expected. The two wells in the Lompoc Terrace aquifer are presently pumped at a combined rate of about 350 acre-feet per year (afy), which exceeds the annual average natural recharge by approximately 100 afy. Because the amount of water in storage above mean sea level is approximately 30,000 acre-feet, such a small depletion in storage is not considered a significant short-term impact (USAF, 1987a). Over the long-term, continued groundwater pumping could result in an overdraft of basin storage and risk of supply depletion. VAFB is considering well maintenance, and basin management and monitoring programs to ensure adequate supply in the source basin and protect against potentially adverse environmental impacts.

The second operational impact will be the discharge of launch deluge and washdown water. Approximately 50,000 gallons per launch of the deluge and washdown water will not evaporate and will be discharged into Spring Canyon. This discharge water will flow into an intermittent pond at the Coast Road embankment and percolate to the groundwater system. This discharge requires a permit from the California Regional Water Quality Control Board. Water levels of monitoring wells downgradient from SLC-4E, appear to fluctuate in response to a discharge (Stearns Catalytic, 1987). As part of the discharge permitting process, a hydrogeologic assessment report is presently (1/88) being prepared for SLC-4. This report will assess the impact of the deluge water discharge upon groundwater hydrology in Spring Canyon.

2.1.4.2 Surface Water

Three major streams drain VAFB -- the Santa Ynez River, San Antonio Creek, and the Santa Maria River. None of these streams occurs in the vicinity of SLC-4. Numerous smaller ephemeral and intermittent streams drain the steeper coastal canyons on the base (SDSU, 1976). One of these streams, Spring Canyon Creek, lies 0.1 mile south of and directly downslope from SLC-4 (Figure 2.1.4-4).



SOURCE: USAF, 1978

FIGURE 2.1.4-4

MAP OF IMPORTANT STREAMS AND SANTA YNEZ RIVER 100-YEAR FLOODPLAIN

Spring Canyon Creek originates approximately 1.4 miles inland and flows towards the ocean. The creek flows only in direct response to precipitation, although several small seeps occur. Flow varies between 0.0 and about 0.51 cubic feet per second (cfs) (Versar, 1987). Surface flow in Spring Canyon does not discharge into the ocean. Instead, stream flow is ponded at the Coast Road embankment and percolates into the groundwater system. This water eventually reaches the Pacific Ocean through groundwater transport processes (Stearns Catalytic, 1987).

Two other nearby streams include Bear Creek and Canada Honda Creek. Both streams are located 1 and 2 miles, respectively, from SLC-4 and will not be impacted by the normal operations of SLC-4E.

On North VAFB, the ephemeral stream in Canada Tortuga, which lies about 1 mile west of Bldgs 5500, 8337, 8401, and 9325, is about 2 miles long and discharges into the Pacific Ocean. Discharge data for Canada Tortuga are not available. Canyon Lakes, which lie about 1 mile east of Bldgs 5500, 8337, 8401, and 9325, are controlled by manmade dams. They have a combined surface area of approximately 27.3 acres and a storage volume of 146.2 acre-feet.

The Lompoc area receives most of its annual precipitation from November through March. The annual precipitation exceeded 14 inches from 1978 to 1983, then decreased to 9 inches in 1984 and 1985. The total precipitation in 1983 exceeded 32 inches, which is the highest amount since 1948, a 40-year period.

The project sites are at least 2 miles from and at an elevation far above that of the Santa Ynez River 100-year floodplain (Figure 2.1.4-4). Construction or operation of the project will not be affected by a major flood along the river.

Impacts

Because of its close proximity, the only water course to be affected by the Titan IV operation at SLC-4E will be the ephemeral stream in Spring Canyon. Discharges of deluge and washdown water, approximately 50,000 gallons per launch, will be routed into Spring Canyon by conduit in order to prevent erosion. These discharges will increase surface flow in Spring Canyon, but will be contained at the

Coast Road embankment. Because of the intermittent nature and relatively low volumes of these discharges, no significant impact to surface water hydrology is expected.

2.1.5 WATER QUALITY

2.1.5.1 Groundwater

Groundwater quality of the SLC-4 area is described by Stearns Catalytic (1987). Spring Canyon data were collected between 1984 and 1986 from the four groundwater monitoring wells shown on Figure 2.1.5-1. Recent groundwater monitoring has been suspended while new monitoring wells in Spring Canyon are drilled as part of the Air Force Installation Restoration Program (IRP).

The generalized chemical characteristics of the groundwater are summarized in Table 2.1.5-1. Groundwater quality is generally poor to medium, with concentrations of total dissolved solids (TDS), chloride, and iron exceeding drinking water standards of 500, 250, and 0.3 mg/l, respectively. Data from the two monitoring wells nearest to the effluent discharges from SLC-4 include significantly higher values for iron, manganese, zinc, sodium, calcium, and dissolved solids than data from the upgradient monitoring well. Groundwater data also indicate the presence of low levels of two organic compounds: trichloroethylene (TCE) and trans-1,2-dichloroethylene (TCEE2).

Impacts

Potential sources of groundwater contamination associated with Titan IV construction and operation at SLC-4E include:

1. discharge of spent deluge and washdown water from the exhaust duct sump (EDS) into Spring Canyon;
2. discharge of nonindustrial sanitary waste from an onsite package sewage treatment plant (STP); and
3. leaching and/or erosion of heavy metals and other contaminants.

During vehicle launch, water will be used in the deluge process and subsequent launch complex washdown. Because of the increased size of the Titan IV over the Titan 34D, greater amounts of deluge water up to

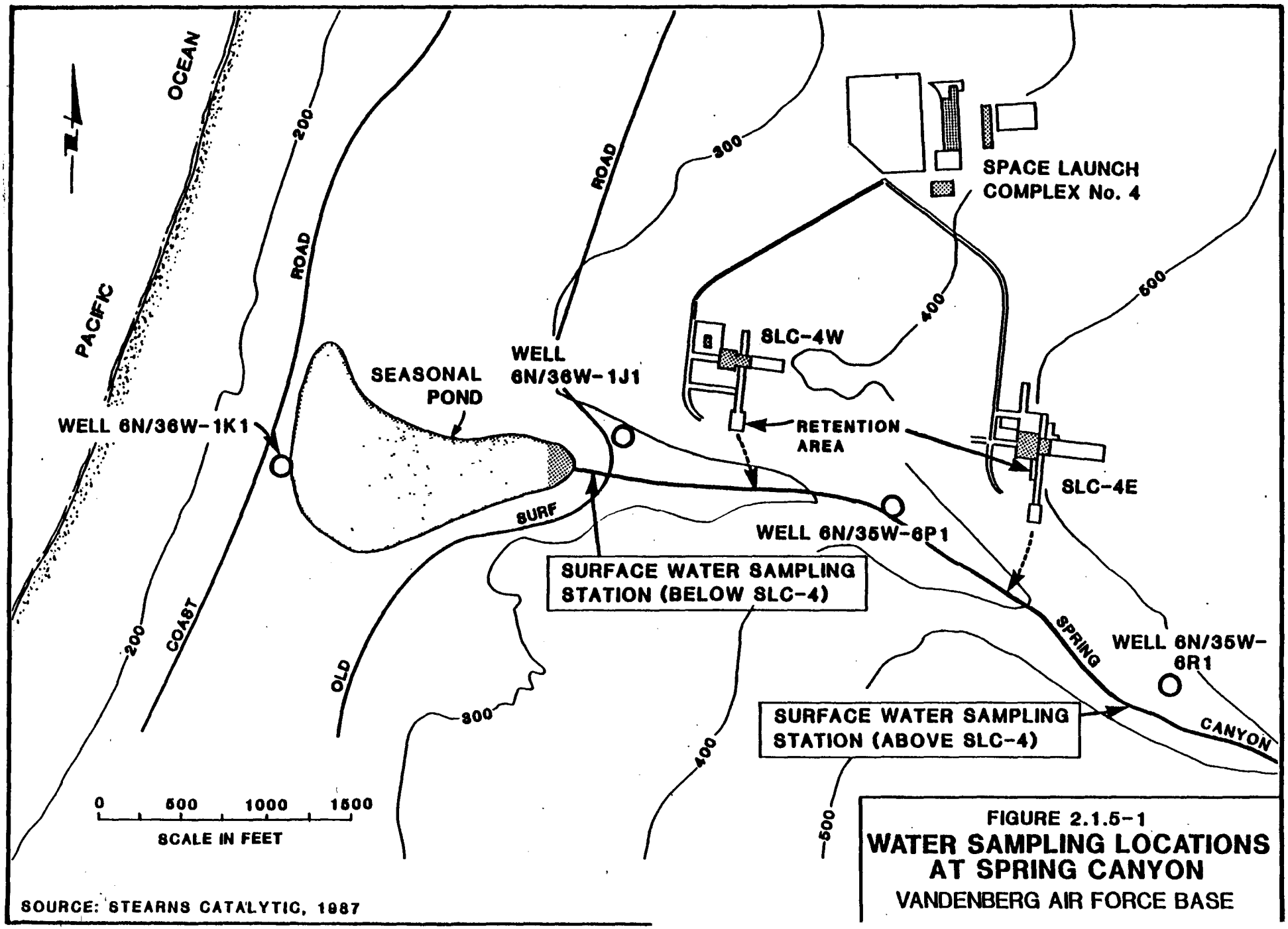


FIGURE 2.1.5-1
WATER SAMPLING LOCATIONS AT SPRING CANYON
VANDENBERG AIR FORCE BASE

TABLE 2.1.5-1

GROUNDWATER QUALITY DATA FOR THE SPRING CANYON AREA

GWOW: #31 UP #30 Dn #3 ~SCP #4 ~Coast Rd

Constituents[a]	Monitoring Wells 6N/35W -6R1 *	6N/35W -6P1 ***	6N/36W -1J1	6N/36W -1K1	MCL[b]
Observations	1	1	4	2	
Calcium	25	38	73	95	-
Magnesium	20	27	76	43	-
Sodium	19	19	457	175	160
Sulfate	48	33	270	245	250
Chloride	354	372	825	240	250
Iron	1.46	3.37	1.62	0.11	0.3
Manganese	0.09	0.22	0.52	1.30	0.5
Zinc	0.07	0.65	0.5	0.12	5
TDS	664	842	1800	1050	500
Total Hardness	145	206	497	415	-
Alkalinity	80	109	67	346	-
pH (units)	6.9	7.07	6.37	7.03	6.5-8.5
Arsenic (ug/l)	<10	<10	2.12	0.75	50
Barium (ug/l)	<200	<200	250	-	1000
Cadmium (ug/l)	<10	<10	3.5	1.0	10
Copper (ug/l)	<20	<20	15.8	4.5	1000
Lead (ug/l)	22	<20	2.25	1.0	50
Boron (ug/l)	<500	<500	497.5	115.0	-
Nitrate	<0.1	<0.1	-	-	10

[a] mg/l, except where noted.
[b] MCL = Maximum Contaminant Levels of National Interim Primary and National Secondary Drinking Water Regulations.
Source: USAF, 1986c; Stearns Catalytic, 1987.

* 19 Jun 96 Bio sample

50,000 gallons may be necessary. Starting 10 to 12 seconds before launch, an estimated average of 120,000 gallons and a maximum of 170,000 gallons of deluge water will be released within approximately 9 to 10 minutes to suppress acoustic levels and dissipate excess heat from the launch platform area (MMC, 1986d; Pergler, 1988b). This represents an increase of 50,000 gallons of deluge water over the amount used for the Titan 34D. Additional water may be released for fire suppressant and launch complex washdown. The spent deluge and washdown water will then be collected in the EDS and flame bucket. Additional water may be present from sources such as precipitation, fire fighting, and water

line breakages occurring during launch. Approximately 50,000 gallons of deluge water per launch will not evaporate and will be discharged.

In the past, the Air Force discharged the spent deluge and washdown water from the SLC-4E EDS into Spring Canyon. The Regional Water Quality Control Board, Central Coast Region (RWQCB) has since required the Air Force to submit Reports of Waste Discharge for such discharges. The Air Force was not required to obtain a National Pollutant Discharge Elimination System (NPDES) permit because surface flow in Spring Canyon is blocked at the Coast Road embankment and does not flow above ground into the ocean (Meese, 1987). The RWQCB considered the wastewater quality poor enough to require some mitigation before state Waste Discharge Requirements (WDR) could be issued (ES, 1986b). Table 2.1.5-2 summarizes the chemical characteristics of previous discharges from the SLC-4E EDS from 1982 to 1987. The post-launch discharges have generally shown high concentrations of copper, iron, lead, mangenese, zinc, aluminum, and TDS. These discharges have most likely contributed to reduced water quality in monitoring wells below the discharge point (Table 2.1.5-1).

As part of the ongoing permit process, the Air Force is collecting and analyzing additional data on the quantity, quality, and beneficial uses of groundwater in the area. The RWQCB will consider potential beneficial uses of water in the area, potential for contamination, treatment of waste in the soil, and dilution within the aquifer when setting effluent discharge limits to prevent degradation of water quality. The Air Force will consider drinking water standards as guidelines for wastewater quality (ES, 1986b). Discharge of water exceeding these standards would require RWQCB permission.

Until a permit has been issued, the deluge and washdown water will be analyzed after each launch and the results will be reported to the RWQCB before any discharge takes place. The tests to be performed are EPA tests 601 (volatile halocarbons) and 602 (volatile aromatics), a test for ICP metals, and a general mineral analysis. If the weighted average levels of contaminants in the launch water are higher than drinking water standards, the {RWQCB must give permission} to discharge the wastewater. The RWQCB may also require treatment of the wastewater

poor wording

{RWQCB must be contacted for permission!}

TABLE 2.1.5-2

WATER QUALITY DATA FOR EFFLUENT DISCHARGE FROM SLC-4E

Constituents*	1982 Yearly Average	1982 Post Launch	1983 Yearly Average	1983 Post Launch	1984 Yearly Average	1984 Post Launch	1985 Yearly Average	1985 Post Launch	1986 Yearly Average	1987 Yearly Average
Volume (gallons)	44,088	41,325	41,227	17,000	39,092	12,250	43,387	43,500	17,183	20,143
pH (units)	8.2	6.0	7.9	6.0	7.6	2.5	8.1	7.4	7.5	8.0
TDS	1980.3	1170.0	854.7	1526.0	1503.4	1718.5	4006.6	1433.0	1326.0	700.0
Hardness	302.1	1143.0	208.2	452.0	332.7	474.0	298.3	490.0	451.9	207.0
Alkalinity	158.1	70.0	6.2	42.0	4.7	4.0	18.9	75.0	316.8	122.0
Chemical Oxygen Demand	31.9	27.0	29.5	24.0	577.1	95.0	392.1	56.0	1091.6	15.0
Total Organic Carbon	11.5	4.0	5.3	6.0	18.6	5.0	6.7	18.0	307.6	4.7
Calcium	85.0	117.2	56.9	128.8	84.6	103.5	79.8	139.7	137.7	57.0
Magnesium	21.9	30.8	16.1	31.7	23.7	32.9	24.8	34.2	26.1	15.7
Potassium	5.8	6.5	4.3	4.9	6.9	7.7	7.1	7.7	6.6	5.0
Sodium	297.1	39.0	176.2	117.8	339.0	84.0	1057.0	107.1	432.6	143.5
Chloride	639.0	350.0	260.4	380.0	473.4	-	2046.7	400.0	463.5	239.0
Sulfate	76.8	68.0	49.2	67.0	630.0	-	96.0	-	-	-
Nitrate	8.2	1.5	3.0	1.3	2.3	-	2.1	-	3.7	1.3
Cadmium (ug/l)	<10.0	29.0	11.1	50.0	10.3	112.0	10.3	48.0	75.4	13.3
Chromium (ug/l)	50.3	<50.0	53.3	<50.0	50.1	54.0	<50.0	<50.0	67.7	46.7
Copper (ug/l)	46.3	220.5	44.5	164.0	28.1	456.5	32.1	183.0	43.3	21.7
Iron (ug/l)	185.2	3478.5	178.9	3212.0	326.6	5317.0	275.9	6680.0	4629.7	209.3
Lead (ug/l)	<50.0	385.5	59.9	285.0	25.9	219.5	<20.0	38.0	46.2	113.3
Mangnese (ug/l)	52.8	218.5	<50.0	235.0	<50.0	400.0	<50.0	-	26.1	15.7
Zinc (ug/l)	1141.5	30,100	565.5	37,000	1160.4	60,225	1751.0	42,500	7,377	588.3
Aluminum (ug/l)	998.4	1580.1	156.8	660.0	256.3	2678.5	287.3	3690.0	1008.7	133.3

* mg/l, unless otherwise noted.
Source: USAF, 1986c.

prior to discharge. Because the discharge of spent deluge water into Spring Canyon will be regulated to protect the beneficial uses of groundwater in the area, no significant impact to groundwater is anticipated.

Most of the nonindustrial sanitary waste from SLC-4 is treated at an existing package sewage treatment plant (STP) on site. This plant has a maximum capacity of 15,000 gallons per day (gpd) and is currently running between 9,000 and 11,500 gpd. The proposed project will result in an estimated additional 1,200 gpd discharge from condensation of precooling coils, reverse osmosis, water softening, and boiler blowdown from the new MST Air Conditioning Building. It was determined that this additional wastewater discharge will not impact the existing system. Waste from the treatment plant goes to evaporation/percolation ponds located northwest of SLC-4E (at Bldg 743). The SLC-4 STP has intermittently been in non-conformance with standards for 5-day BOD and suspended solids. A replacement STP will be constructed by 1990, possibly sooner, to adequately dispose of sewage waste at SLC-4. Plant capacity is not anticipated to be increased with the new STP.

A small amount of sanitary sewage is discharged from the RIS modular offices into a septic tank-leach field system. This discharge does not require a permit under RWQCB Order 83-12 which establishes an agreement between the RWQCB and the Air Force for small discharges into such systems.

2.1.5.2 Surface Water

Surface flow in Spring Canyon has been sampled quarterly since 1983 from sampling points upstream and downstream of SLC-4. Sampling stations are shown in Figure 2.1.5-1. Because of the ephemeral nature of the stream, the Air Force was not able to obtain a surface water sample above SLC-4 on a regular basis. Since 1962 Spring Canyon has experienced considerable physical disturbance associated with construction, maintenance, and operation of SLC-4 (Versar, 1987). The generalized chemical characteristics of Spring Canyon surface flow is summarized in Table 2.1.5-3. Water quality is generally recognized as

TABLE 2.1.5-3

SURFACE WATER QUALITY DATA FOR SPRING CANYON

Parameter[a]	Sampling Station Above SLC-4			Sampling Station Below SLC-4			
	1983	1984	1986	1983	1984	1985	1986
pH (units)	6.42	6.00	6.00	6.99	7.50	7.68	6.67
Total Organic Carbon	24.50	23.00	31.00	25.00	35.60	34.70	18.00
Chemical Oxygen Demand	87.50	120.00	325.00	59.00	179.20	190.30	112.50
Dissolved Oxygen	8.45	-	-	5.70	8.75	9.70	8.40
Chloride	280.00	-	580.00	316.00	550.00	593.30	670.00
Nitrate	<0.10	0.40	<0.10	0.10	0.05	-	0.10
Calcium	15.05	27.30	70.20	62.60	62.30	75.50	53.25
Magnesium	21.40	13.40	47.00	52.85	47.10	73.10	49.50
Sodium	173.90	24.70	296.00	206.45	303.20	367.60	306.54
TDS	872.50	-	1,220	879.50	550.00	593.30	1,407
Total Hardness	125.50	123.00	369.00	373.50	349.60	489.70	373.00
Alkalinity	44.00	-	162.00	148.50	193.20	143.30	157.50
Arsenic (ug/l)	<10.00	-	-	502.50	<10.00	-	-
Copper (ug/l)	<20.00	-	-	28.50	34.00	-	-
Iron (ug/l)	7,822	3,728	48,640	512,751	26,952	7,272	4,680
Lead (ug/l)	17.50	-	-	17.50	-	-	-
Zinc (ug/l)	<50.00	-	-	70.00	70.00	-	-
Aluminum (ug/l)	3,602	38,700	805.00	35,520	1,157	108.70	250.00

[a] mg/l, except where noted.
Source: USAF, 1986c.

poor to medium with high concentrations of sodium, chloride, iron, aluminum, and TDS. Dissolved oxygen and pH values have fallen above and below EPA-accepted levels of 5.0 mg/l and 6.5 to 8.5 (units), respectively, for aquatic life. In addition, high values of iron may exceed accepted safe levels for aquatic life based on toxicity bioassays. Surface water was not sampled for organic compounds.

Impacts

Potential sources of surface water contamination associated with construction and operation of the Titan IV program at SLC-4E include:

1. discharge of spent deluge and washdown water from the EDS into Spring Canyon;
2. discharge of stormwater runoff from the EDS into Spring Canyon;
3. launch-pad accidents and propellant spills;
4. in-flight failures that might result in propellant falling into the ocean or a nearby onshore water body; and
5. contamination of surface water from exhaust ground cloud deposition of HCl and Al_2O_3.

The discharge of deluge and washdown water into Spring Canyon, as described in section 2.1.5.1, has had a direct impact on surface water quality. Higher concentrations of iron, copper, zinc, calcium, magnesium, and chloride occur at the sampling point downstream of SLC-4 than at the sampling point upstream of SLC-4 (Table 2.1.5-3). The RWQCB's issuance of Waste Discharge Requirements for the discharge of deluge and washdown water will consider beneficial uses of surface water in Spring Canyon, including preservation of aquatic life, and will require that proper mitigation measures be taken to protect these beneficial uses and prevent further degradation of surface water quality. These measures are expected to minimize significant impacts to surface water from the discharge of deluge and washdown water.

Stormwater is a potentially large portion of the wastewater discharged between launches because the entire launch pad drains into the flame bucket and the EDS. The Titan IV program will include the installation of a valve between the flame bucket and the EDS in order to preclude contamination of stormwater with chemicals existing in the EDS. The stormwater, segregated in the flame bucket, will be tested before being released through the retention basin and into Spring Canyon. The EDS will be bypassed and will serve only as a spill containment structure. There is presently no requirement to test or prevent the discharge of stormwater. The RWQCB has requested further information on

stormwater runoff quality to determine if residues from the launch pad will contaminate stormwater and if treatment would be necessary prior to discharge. Currently no coordination with the RWQCB is required before discharge. Treatment of stormwater, if determined to be necessary, would mitigate stormwater impacts to surface water quality in the Spring Canyon drainage.

Accidental releases of small quantities of fuel and propellants may occur on the launch pad as a result of the Titan IV program at SLC-4E. Although rapid propellant evaporation would occur, any spill would be retained in the impervious holding areas surrounding the fuel and propellant supply tanks or in the EDS downgrade of the launch pad. The containment structures and their capacities are shown in Table 2.1.5-4. Spilled propellant will be removed following procedures outlined in the Spill Prevention Control and Countermeasure Plan, and stored at the hazardous waste storage facility on the base pending off-site disposal. A propellant spill will not significantly impact water quality around SLC-4E.

TABLE 2.1.5-4

CAPACITIES OF SPILL CONTAINMENT STRUCTURES AT SLC-4E

Structure	Capacity (gal)
EDS (including flame bucket)	280,000
Fuel Holding Area (FHA) Sump	1,413
Oxidizer Holding Area (OHA) Sump	1,413
Ready Storage Vessel (RSV) Sump	673
Fuel Waste Tank	25,000
Oxidizer Waste Tank	25,000

Source: MMC, 1986d

The potential exists for an early inflight termination and activation of the vehicle destruct system. Due to the hypergolic nature of Aerozine-50 and N_2O_4, most of the propellant would ignite and burn. In the event that inflight termination occurred prior to Stage I separation, most of the unused solid propellant would ignite and burn. This would result in peak ground level concentrations of HCl, CO_2, N_2 and Al_2O_3. Depending on atmospheric conditions, it is conceivable that

peak concentrations of HCl and Al_2O_3 may result in deposition to standing water in Spring Canyon. However, the occurrence of a persistent exhaust ground cloud during launch is reduced by pre-launch meteorological monitoring and the resulting decision to launch, as discussed in Subsection 2.1.1.3.

A worst-case failure would involve not only a near-pad failure of the Titan IV vehicle, but also the simultaneous failure of the core vehicle destruct system, which has never occurred. Under such worst-case conditions, it is possible that some liquid propellant might enter the ocean and/or nearby surface water. The degree of impact would be dependent on the amount of propellant released and the depth of the water column. Based on a dispersion model for an East Coast Titan IIIC or Titan IIID launch failure, the radius of the contaminated area could vary from approximately 800 to 8,000 feet, depending on the amount of propellant entering the ocean (USAF, 1975). In the unlikely event of a worst-case flight failure and failure of the vehicle destruct system, localized short-term impacts to water quality could occur.

The final surface water quality consideration is the potential interaction between the exhaust ground cloud produced by the Titan IV launch vehicle and the adjacent surface water. The impact of the ground cloud on surface water quality will be a function of the composition of the exhaust cloud, duration of its contact with the water, wind speed and direction, and other atmospheric conditions. To date, no studies have been conducted on the direct effect of Titan IV launch activities at VAFB on adjacent surface waters. However, an evaluation of the potential ground cloud impacts for the Titan IV launches at Cape Canaveral is described by the USAF (1986a).

The Titan IV ground cloud will consist primarily of HCl, Al_2O_3, and CO_2 (see Section 2.1.2.2). The primary concern associated with the ground cloud impacts on water quality is formation of large quantities of HCl. Short-term acidification of surface water may result from direct contact with the ground cloud and through deposition of HCl in the form of dryfall. Deposition of HCl in wet precipitation will be a function of ambient weather conditions. Incidences of local washout of HCl are expected to occur only under rainfall conditions. Launch

constraints do not allow liftoff during rain or storm conditions. Due to atmospheric diffusion of the exhaust cloud, impacts to surface waters will likely be restricted to the area immediately adjacent to SLC-4E. Under certain atmospheric conditions, surface flows in Spring Canyon could potentially experience a short-term increase in acidity due to HCl deposition.

Surface water sampling in Spring Canyon indicates that water quality can be strongly affected by launch activities. Alkalinity and pH values of surface water upstream of SLC-4E were very low and outside the range of values reported for other similiar streams on VAFB (Versar, 1987). Because these samples were upstream of SLC-4E, this suggests the impacting factor was HCl deposition from a ground cloud. Downstream of SLC-4E, pH values were higher and returned to normal values of other Vandenberg streams. This indicates that any decrease in pH in this region will be short in duration and will be rapidly neutralized by the buffering system within Spring Canyon.

A second concern associated with the ground cloud of the Titan IV is the potential impact of Al_2O_3 on surface water quality. Deposition of Al_2O_3 will also be limited by diffusion of the ground cloud and will most likely impact only the Spring Canyon area. Surface water quality in Spring Canyon has been impacted by Al_2O_3 deposition as indicated by occasional high values of aluminum (see Table 2.1.5-3). However, due to the infrequency of launches, this impact is not anticipated to be significant.

2.1.6 BIOTA

Meteorological and biological investigators commonly characterize VAFB as a borderland, a biogeographic boundary area, between the coastal southern and central California coast. The biology of the VAFB region has been well documented in previous studies (USAF, 1976d, 1976a, 1977a, 1983a). The baseline information presented herein summarizes these and other previous studies. A recent Environmental Assessment (Versar, 1987) provides current baseline data for the SLC-4 area.

The approximately 600-acre SLC-4 site and 35-acre RIS/X-Ray facility contain five major plant communities: (1) central dune scrub,

(2) central coastal scrub, (3) coastal sage-chaparral scrub, (4) freshwater wetlands and riparian woodland, and (5) ruderal vegetation. Additional detailed, site-specific information on biota and habitats of SLC-4 is available in Versar (1987). Information on site-specific and regional impacts to biota and habitats is presented in subsections 2.1.6.1 to 2.1.6.5. Figures 2.1.6-1, 2.1.6-2, and 2.1.6-3 present an overview of vegetative community distributions on VAFB, SLC-4, and the RIS/X-Ray facility, respectively.

As shown in Figure 2.1.6-1, VAFB is comprised of eleven major plant communities, including three phases of Coastal Sage Scrub (also known as Central Coastal Scrub). Vegetative communities that occur on VAFB, but which do not occur in the SLC-4 area or in an area where they would be adversely impacted by the proposed Titan IV project, are: (1) Coastal Salt Marsh, (2) Chaparral (high ridges and mesas), (3) Bishop Pine Forest, (4) Tanbark Oak Forest, and (5) Live Oak Woodland. These vegetative communities are described in studies referenced earlier.

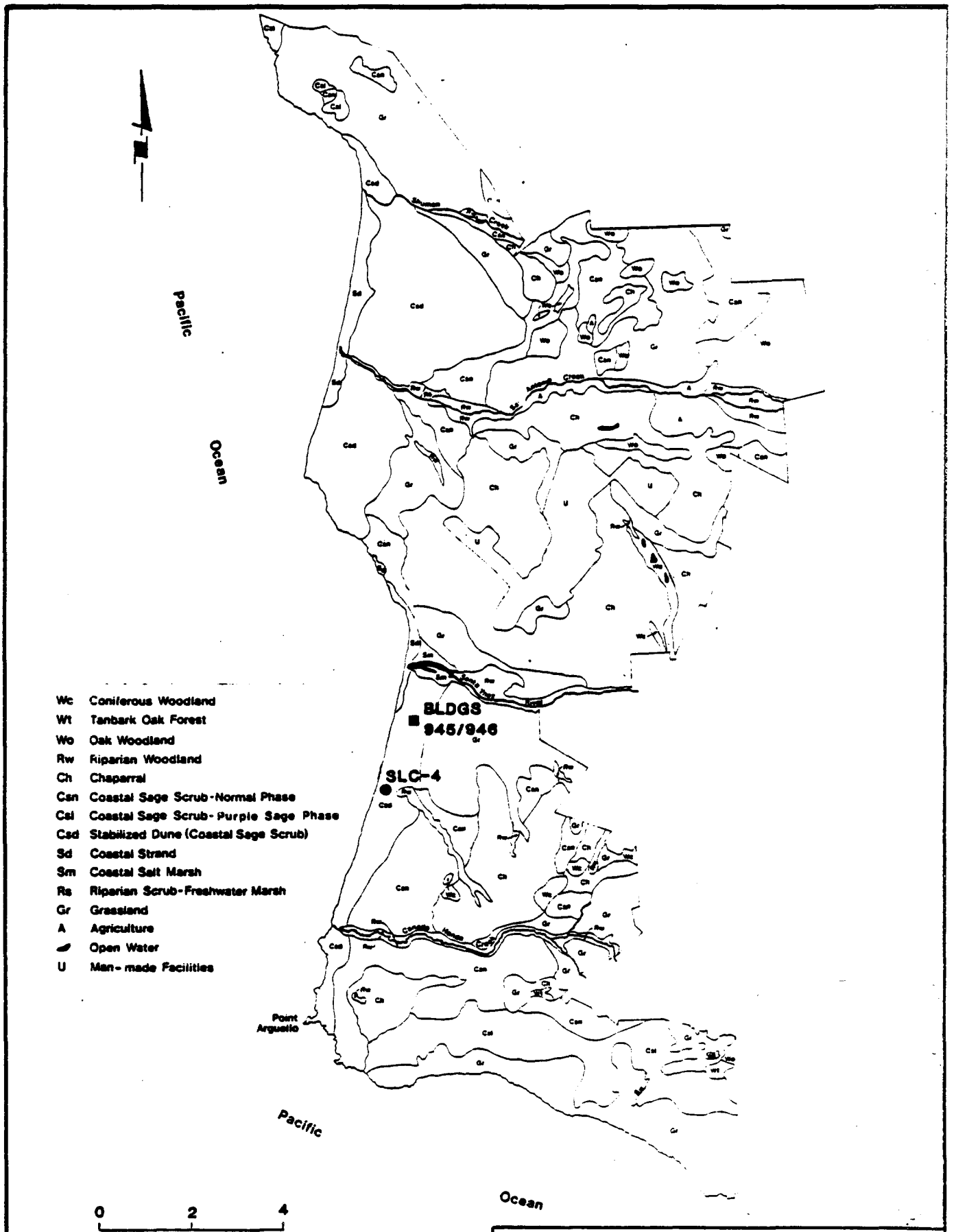
Animals generally adapt to a fairly specific set of biotic and abiotic conditions. Combinations of these conditions often coincide with specific types of vegetation. Because vegetation characteristics are significant determinants of faunal distribution patterns, vegetation type is used herein as a convenient and meaningful unit for the discussion of wildlife.

Observations of faunal distributions and diversity in the VAFB region are available in previous studies. Site-specific observations for SLC-4 are discussed in the following subsections.

2.1.6.1 Terrestrial Biota

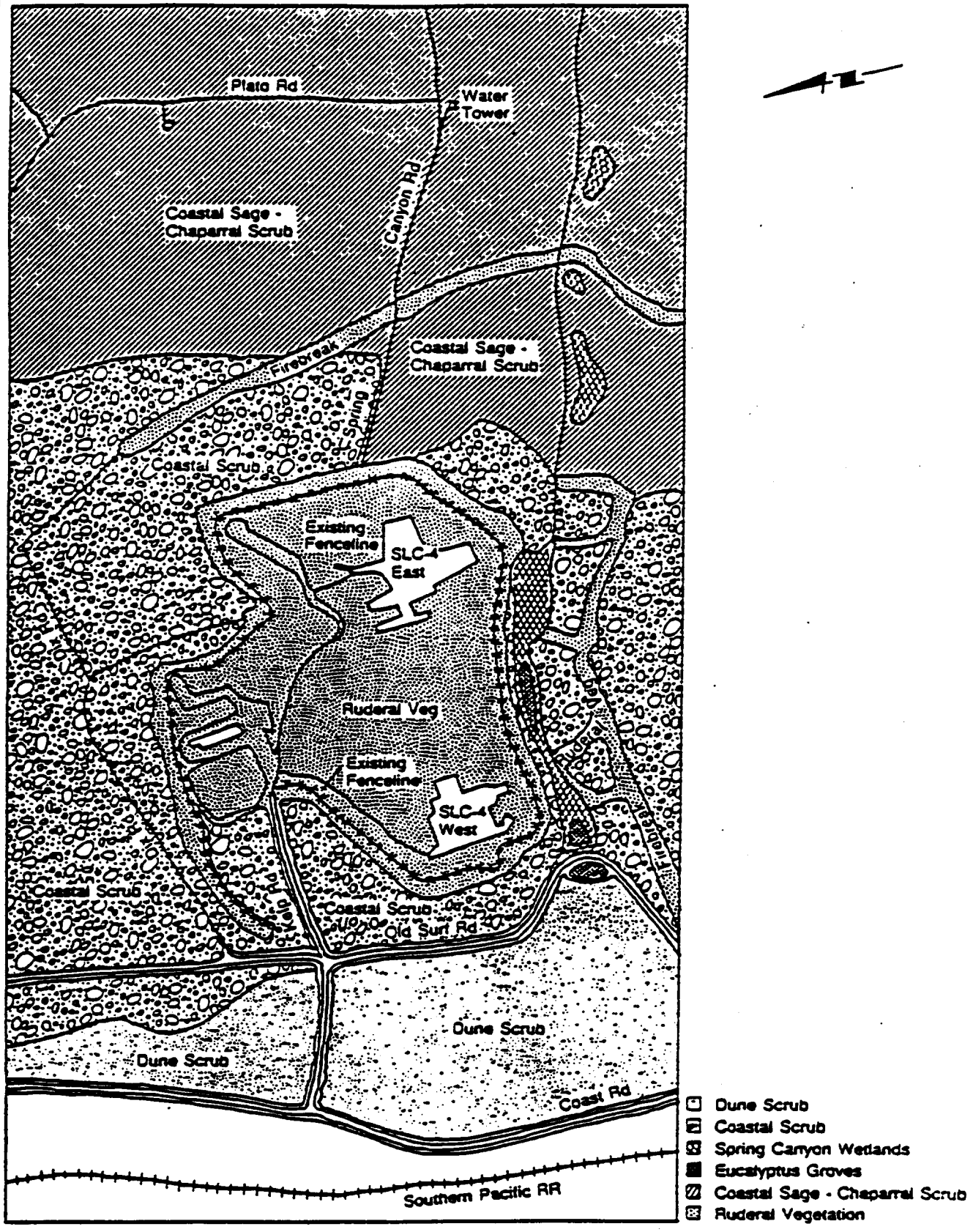
The area between Point Conception and Point Sal, which includes VAFB, is generally considered a biological transition zone between southern and central California. Many species reach their northern or southern limits in the vicinity of Point Conception.

The biogeographical significance of the five major vegetative communities present in the vicinity of SLC-4 are discussed below in terms of successional status, sensitivity to disturbance, and the influence of human activity.



SOURCE: USAF, 1978a

FIGURE 2.1.6-1
GENERALIZED VEGETATION OF VANDENBERG AIR FORCE BASE



SOURCE: Versar, 1987

FIGURE 2.1.6-2

VEGETATION OF SLC-4

VANDENBERG AIR FORCE BASE

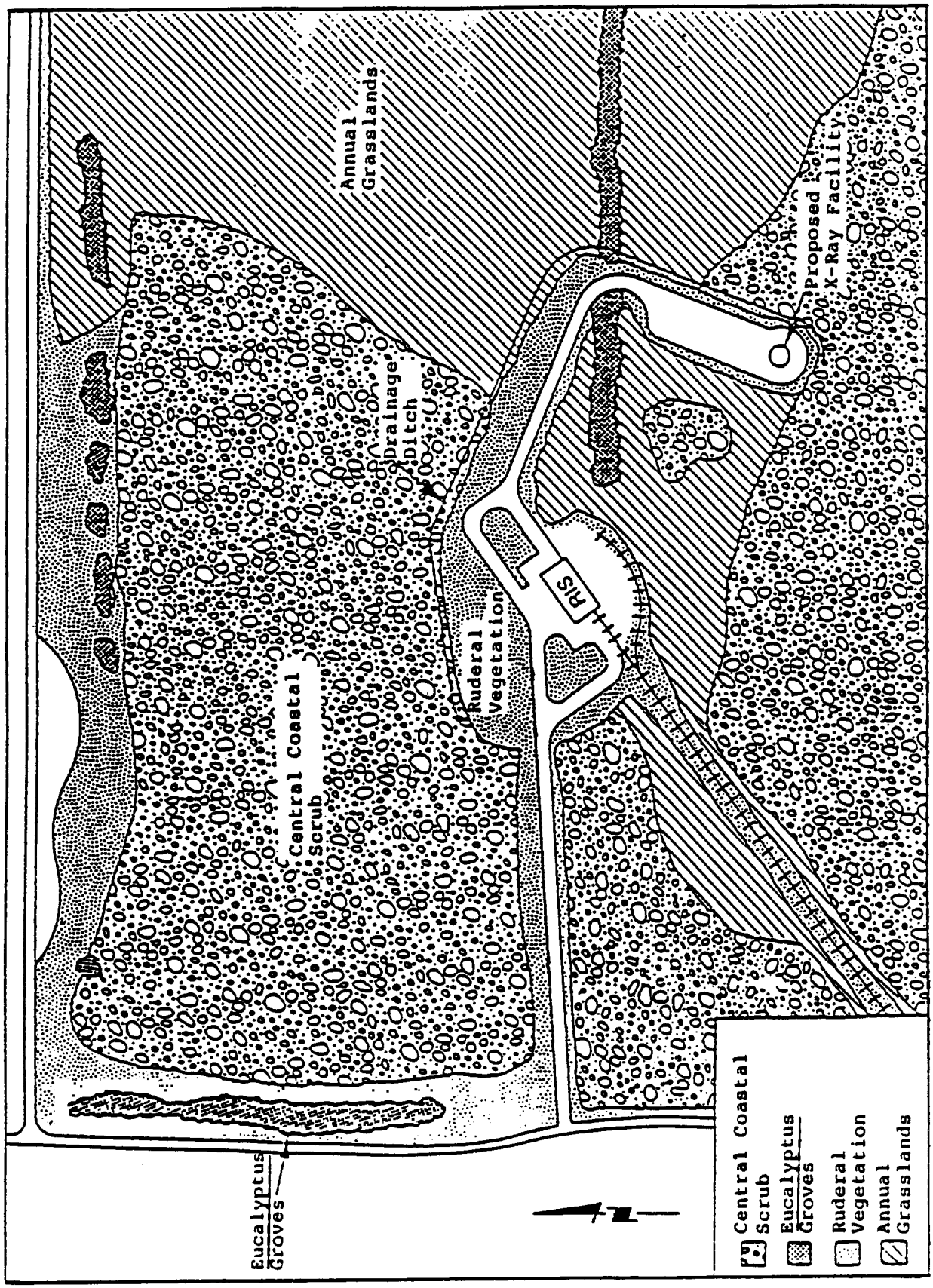


FIGURE 2.1.6-3

VEGETATION OF RIS/X-RAY FACILITIES

VANDENBERG AIR FORCE BASE

SOURCE: Versar, 1987

A. Central Dune Scrub

A Central Dune Scrub community occurs along the western perimeter of the project site between Old Surf and Coast Roads, where the terrain consists of gradually sloping hills of loose sand (Figure 2.1.6-2). Central Dune Scrub vegetation often consists of a dense cover of shrubs 3 feet in height or higher. Dominant shrubs include dune lupine (Lupine chamissonis), mock heather (Haplopappus ericoides), and California sagebrush (Artemisia californica). Several subshrubs occur commonly amidst the taller vegetation, particularly in openings and disturbed areas. These plants include curly-leaved monardella (Monardella undulata var. frutescens), cudweed aster (Corethrogyne filaginifolia), and Blochman's groundsel (Senecio blochmaniae). Scattered patches of introduced species such as hottentot fig (Carpobrotus edulis) and narrow-leaved iceplant (Conicosia pugioniformis) are present at the site, although these nonnative species have not invaded the dune scrub habitat in the vicinity of SLC-4 as extensively as in other areas on VAFB. The Central Dune Scrub community near SLC-4 is less diverse than is typical of the region.

Central Dune Scrub has been classified as a threatened and declining vegetation type in California because of its susceptibility to damage from urban and oil development and recreational use (Jensen, 1983). The unconsolidated nature of the soils inhabitated by Central Dune Scrub vegetation make this plant community prone to damage by trampling and offroad vehicle use. The Central Dune Scrub habitat forms an important interface between active coastal foredunes and stabilized upland slopes, and may be utilized by beach and foredune wildlife for foraging and refuge. The Central Dune Scrub community in the vicinity of SLC-4 is relatively undisturbed and was not damaged by the Titan 34D explosion of April 1986.

Several rare plant species, which, for purposes of this report, are those either listed as federal candidate species and/or listed as rare by the California Native Plant Society, occur in Central Dune Scrub communities near SLC-4. These species include soft-leaved Indian paintbrush (Castilleja mollis), curly-leaved monardella, Blochman's leafy daisy (Erigeron foliosus var. blochmaniae), large-leaved

wallflower (Erysimum suffrutescens var. grandifolium), and black-flowered figwort (Scrophularia atrata) (Versar, 1987).

Central Dune Scrub habitat near SLC-4 is characterized by relatively few species of wildlife because of limited food availability and the lack of cover. Species characteristic of the Central Dune Scrub community that are expected to occur near SLC-4 include the western fence lizard (Sceloporus occidentalis), California legless lizard (Anniella pulchra), gopher snake (Pituophis melanoleucus), American kestrel (Falco sparverius), Say's phoebe (Sayornis saya) Bewick's wren (Thryomanes bewickii), California thrasher (Toxostoma redivivum), yellow-rumped warbler (Dendroica coronata) white-crowned sparrow (Zonotrichia leucophris), song sparrow (Melospiza melodia), deer mouse (Peromyscus sp.), California ground squirrel (Spermophilus beecheyi), and brush rabbit (Sylvilagus bachmani). Carnivores such as raccoon (Procyon lotor), coyote (Canis latrans), and striped skunk (Mephitis mephitis) occasionally forage in Central Dune Scrub habitat, but are not expected to be permanent residents. These species are all expected to occur near SLC-4.

No threatened or endangered species of wildlife are expected to frequent Central Dune Scrub habitat in the vicinity of SLC-4. Cooper's hawk (Accipiter cooperii), northern harrier (Circus cyaneus), merlin (Falco columbarius), and burrowing owl (Athene cunicularia) are the only regionally rare or declining wildlife species expected to forage in this habitat. A burrowing owl was observed in Central Dune Scrub habitat in the vicinity of SLC-4 during a field survey conducted in November 1986 (Versar, 1987).

B. Central Coastal Scrub

Central Coastal Scrub is the most extensive plant community in the vicinity of SLC-4 (Figure 2.1.6-2). It is the dominant vegetation type on the north-facing slope above Spring Canyon, where it also intergrades with Coastal Sage-Chaparral Scrub. On the western or downslope portion of the site, it intergrades with the Central Dune Scrub community. On the eastern side of SLC-4, it intergrades with the Coastal Sage-Chaparral Scrub community.

Central Coastal Scrub is characterized by a dense cover of shrubs 3 to 7 feet in height. Dominant species include California sagebrush, mock heather, black sage (Salvia mellifera), California coffeeberry (Rhamnus californica), coyote brush (Baccharis pilularis ssp. consanguinea), and poison oak (Toxicodendron diversilobum). Herbaceous species are uncommon beneath the scrub canopy, but are abundant in open areas and along roadsides and firebreaks. Common scrub species include figworts (Scrophularia spp.), chaparral morning glory (Calystegia macrostegia var. cyclostegia), California blackberry (Rubus ursinus), California croton (Croton californicus), white yarrow (Achillea borealis), and branching phacelia (Phacelia ramosissima).

Several portions of the Central Coastal Scrub community in the vicinity of SLC-4 were burned as a result of the Titan explosion. This community is, however, adapted to periodic burning, and the vegetation in the burned area shows healthy regeneration. Several herbs are associated with previously burned areas and include hummingbird sage (Salvia spathacea), whispering bells (Emmenanthe penduliflora), chaparral nightshade (Solanum xantii), and a Phacelia species. The Central Coastal Scrub community near SLC-4 is typical of that found on VAFB and in northern Santa Barbara County. With the exception of roadcuts, firebreaks, and the recent burn area, it is relatively undisturbed. The numerous species of shrubs present in the Central Coastal Scrub community provide an important source of seed for many wildlife species.

In addition to its wildlife value, the Central Coastal Scrub community is inhabited by several rare plant species. Rare species observed in the Central Coastal Scrub community at SLC-4 include black-flowered figwort, soft-leaved Indian paint brush, large-leaved wallflower, and Blochman's leafy daisy. Plummer's baccharis (Baccharis plummerae) and Hoffmann's snakeroot (Sanicula hoffmannii) are two other rare plants that are expected to occur at SLC-4, based on habitat preference and known distributional patterns. They have, however, not been observed there.

At least 12 species of reptile inhabit Central Coastal Scrub habitat on VAFB (Howald et al., 1985; USAF, 1976d). Western fence

lizard, California legless lizard, western skink (Eumeces skiltonianus), gopher snake, common (Thamnophis sirtalis) and western terrestrial (T. elegans) garter snakes, striped racer (Masticophis lateralis), and western rattlesnake (Crotalus viridis) are the more common species expected to occur near SLC-4. Amphibians tend to be scarce in the Central Coastal Scrub habitat due to aridity. Ensatina (Ensatina escholtzii) and Pacific Treefrog (Hyla regilla) are the most common amphibians that are likely to occur near SLC-4. They occur predominately during the winter. No regionally rare, declining, or sensitive species of amphibian or reptile is expected to inhabit the Central Coastal Scrub habitat in the vicinity of SLC-4.

Common breeding bird species characteristic of Central Coastal Scrub that are expected to occur near SLC-4 include California quail (Callipepla californica), Anna's (Calypte anna) and Costa's (C. costae) hummingbirds, bushtit (Psaltiparus minimus), beckwick's wren, California thrasher, song sparrow, rufous-sided (Pipilo erythrophthalmus) and brown (P. fuscus) towhees, and house finch (Carpodacus mexicanus). Less common breeding birds characteristic of Central Coastal Scrub that are expected to occur near SLC-4 include the greater roadrunner (Geococcyx californianus), loggerhead shrike (Lanius ludovicianus), white-crowned sparrow, and rufous-crowned sparrow (Aimophila ruficeps). Species known or expected to occur within the project area are listed in Versar (1987). A number of regionally rare or declining bird species are expected to forage in Central Coastal Scrub habitat at SLC-4 and include Cooper's hawk, northern harrier, merlin, short-eared owl (Asio flammeus), and burrowing owl.

The dense cover of Central Coastal Scrub vegetation makes it an ideal habitat for small mammals. These mammals in turn are prey for a number of resident carnivores and raptors. The more common small mammals characteristic of Central Coastal Scrub that are expected to occur near SLC-4 include the ornate shrew (Sorex ornatus), Botta's pocket gopher (Thomomys bottae), deer mouse, California mouse, and dusky-footed woodrat (Neotoma fuscipes). The black-tailed jackrabbit (Lepus californicus), brush rabbit, and cottontail are the most common lagomorphs of this habitat. The more common mammalian carnivores of

Central Coastal Scrub habitat include coyote, raccoon, long-tailed weasel (Mustela frenata), striped skunk, and bobcat (Lynx rufus). Badger (Taxidea taxus) tracks and burrows were observed in the Central Coastal Scrub habitat near SLC-4 during October and November 1986 (Versar, 1987). Badgers are the only regionally rare or declining mammal known to inhabit Central Coastal Scrub in the vicinity of SLC-4.

C. Coastal Sage-Chaparral Scrub

Coastal Sage-Chaparral Scrub is a poorly defined plant community that is transitional between Central Coastal Scrub and Coastal Maritime Chaparral. This community occupies the highest elevations in the vicinity of SLC-4 and contains plants characteristic of the Coastal Scrub and Maritime Chaparral communities. It covers both the north- and south-facing slopes on the upper reaches of Spring Canyon and the west-facing slope and ridge crest above SLC-4E (Figure 2.1.6-2).

The vegetation of the Coastal Sage-Chaparral Scrub community is a mixture of soft-leaved deciduous and evergreen sclerophyllous shrubs. Dominant species in the vicinity of SLC-4 include California sagebrush, black sage, sticky monkey flower (Mimulus aurantiacus), poison oak, coyote brush, seacliff buckwheat (Eriogonum parviflorum), and lemonadeberry (Rhus intergrifolia). The Coastal Sage-Chaparral Scrub vegetation at SLC-4 is wind pruned, and low-growing perennial plants are common among the shrubs. Common low-growing species include sand lettuce (Dudleya caespitosa), rush-rose (Helianthemum scoparium), and a perennial grass, Agrostis diegoensis. Chaparral elements characteristic of most Coastal Sage-Chaparral Scrub communities, including Ceanothus spp., toyon (Heteromeles arbutifolia), and scattered oaks (Quercus parvula and Q. agrifolia), were observed at SLC-4.

The Coastal Sage-Chaparral Scrub on the ridge along the northern side of Spring Canyon contains several plant species that are characteristic of a Bishop Pine Forest community, including scattered individuals of bishop pine (Pinus muricata), huckleberry (Vaccinium ovatum), and various ferns. In addition, this ridge also contains a few species characteristic of more mesic habitats, such as yerba buena (Satureja douglasii) and Santa Cruz Island oak (Quercus parvula). The

presence of these species is probably related to the proximity of SLC-4 to the mixed evergreen forest on Tranquillon Peak. The Santa Cruz Island oak is the only rare plant species that was found in the Coastal Sage-Chaparral Scrub community in the vicinity of SLC-4.

The south-facing slope above Spring Canyon contains several outcrops of diatomaceous shale. The Coastal Sage-Chaparral Scrub vegetation surrounding these outcrops contains some elements of Burton Mesa Chaparral. Chamise (Adenostoma fasiculatum) and Purisima manzanita (Arctostaphylos purisima) are common. Several scattered bishop pine and toyon are also present.

Most of the Coastal Sage-Chaparral Scrub community in the vicinity of SLC-4 appears to be in a mature undisturbed stage. Only a few scattered individuals of introduced species, including veldt grass (Ehrharta calycina), hottentot fig, and pampas grass (Cortaderia atacamensis), occur near firebreaks and along roadsides. Only a small percentage of the area covered by this community was burned as a result of the Titan explosion. With the exception of blue blossom ceanothus (Ceanothus thyrsiflorus), the vegetation in the burned area is regenerating from rootstocks. Coastal Sage-Chaparral Scrub is a vegetation type that is well-adapted to fire.

A number of reptiles characteristic of Coastal Sage-Chaparral Scrub habitat are expected to occur near SLC-4, and include western fence lizard, side-blotched lizard (Uta stansburiana), western rattlesnake, striped racer, and western terrestrial garter snake. The coast horned lizard (Phrynosoma coronatum), western whiptail (Cnemidophorus tigris), and long-nosed snake (Rhinocheilus lecontei) are three reptile species that reach their northwestern range limits in Santa Barbara County in Burton Mesa Chaparral. These species are not expected to occur in the vicinity of SLC-4. Chaparral supports relatively few species of amphibian, but does support pacific treefrog, California slender salamander (Batrachoseps attenuatus), and the salamander Ensatina. Amphibians occur in Chaparral habitat mainly during winter. No regionally rare or declining species of amphibian or reptile occurs in Chaparral habitat near SLC-4.

Birds characteristic of Chaparral that are expected to occur near SLC-4 include California quail, greater roadrunner, Anna's hummingbird, Costa's hummingbird, Bewick's wren, scrub jay (Aphelocoma coerulescens), wrentit (Chamaca fasciata), California thrasher, golden-crowned sparrow (Zonotrichia atricopilla), rufous-sided and brown towhees, and lesser goldfinch (Carduelis psaltria). Regionally rare and declining bird species expected to forage in Chaparral in the vicinity of SLC-4 include Cooper's hawk and tree swallow (Tachycineta bicolor) (Lehman, 1982).

Rodents inhabiting Chaparral that are expected to occur near SLC-4 include Botta's pocket gopher, California pocket mouse (Perognathus californicus), California mouse, deer mouse, pinyon mouse (Peromyscus truei), and dusky-footed woodrat (Neotoma fuscipes). Some of the less abundant small mammals characteristic of Chaparral habitat and expected to occur in Chaparral at SLC-4 include ornate and trowbridge (Sorex trowbridgii) shrews, Merriam's chipmunk (Tamias merriami), agile kangaroo rat (Dipodomys agilis), and western harvest mouse (Reithrodontomys megalotis). Brush rabbit also occurs frequently in Chaparral. This species prefers areas of dense vegetation. Desert cottontail and black-tailed jackrabbit are less common and are found in open areas within Chaparral habitat. Because of the dense protective cover provided by Chaparral and the diversity and abundance of prey species, a number of large, wide-ranging carnivores are found in this habitat. The most common species include coyote, gray fox (Urocyon cinereoargenteus), bobcat, and striped skunk.

Mule deer (Odocoileus hemionus) forage in open areas of Chaparral and seek shelter in dense cover provided by its canopy. The only regionally rare or declining species of mammal expected to frequent Chaparral in the vicinity of SLC-4 is the mountain lion (Felis concolor).

D. Spring Canyon Wetlands

Spring Canyon contains a unique assemblage of wetland communities, including riparian forest, emergent wetlands, and arroyo willow scrub. Wetlands like those in Spring Canyon are declining regionally (Jensen, 1983). Wetlands comprise only 5 percent of the total acreage on VAFB.

The Riparian forest portion of the Spring Canyon wetlands is dominated by blue gum trees (Eucalyptus globulus). These trees exist in two groves in the lower reaches of the canyon. Eucalyptus is not native to California; however, it is commonly found in riparian settings, where it was planted historically. Eucalyptus globulus has become naturalized in the vicinity of SLC-4, and seedlings and saplings are abundant throughout the lower reaches of Spring Canyon. This abundance suggests the existing groves are capable of self-replacement. About half of the existing Eucalyptus trees show fire damage from the Titan explosion. This explosion did not, however, result in the loss of many trees, and most of the fire-damaged trees have regenerated vigorously.

Eucalyptus globulus provides important habitat for wildlife in Spring Canyon. Eucalyptus flowers produce large quantities of nectar, which is utilized by numerous insects and birds. The trees provide both shelter for migratory songbirds and roost and nest sites for many raptors such as red-tailed hawks (Buteo jamaicensis). In addition, Eucalyptus trees in Spring Canyon and other coastal areas are used by monarch butterflies as winter roost sites. Butterfly roosts are considered an environmentally sensitive habitat and are a protected resource within Santa Barbara County (Santa Barbara County, 1982). In the vicinity of SLC-4, the perennially wet soil and partially open canopy have resulted in the formation of dense stands of California and small-fruited bulrushes (Scirpus californica and S. microcarpus) with adjacent scattered clumps of the rush, Juncus effusus var. brunneus. The emergent flora in Spring Canyon provides important habitat for amphibians, such as tree frogs and salamanders.

Dense stands of arroyo willows (Salix lasiolepis) are also found in the Spring Canyon wetlands. These willows are adapted to colonizing and growing in wet areas, and their roots help to stabilize stream banks and prevent erosion. Willows flower early in the spring and produce copious quantities of pollen that provide an important food resource for insects. These insects are prey for birds. Willows also contribute to structural habitat diversity.

The final vegetational element of the Spring Canyon wetlands is emergent vegetation, including broadleaf cattail (Typha latifolia) and

narrowleaf cattail (T. domingensis). Within and around the cattails are other wetland species, including coastal woodfern (Dryopteris arquta), western sword fern (Polystichum munitum), bracken fern (Pteridium aquilinum), stinging nettle (Urtica holosericea), giant horsetail (Equisetum telmateia), and sedge (Carex sp.). Emergent vegetation helps to stabilize stream banks and provides cover for wildlife and insects. On VAFB there are 16 documented winter roosts of the monarch butterfly (Danus plexippus), a species of concern among scientists and citizens (Pergler, 1987). The Spring Canyon roost supports a winter population of approximately 2,000 to 4,000 individuals.

Riparian Woodland and wetland habitats near SLC-4 support a diverse assemblage of amphibians and reptiles. The more common species expected to occur near SLC-4 include pacific treefrog, western toad (Bufo boreas), western aquatic garter snake (Thamnophis hammondii), and western rattlesnake. Ensatina is common in Riparian Woodlands on VAFB (USAF, 1976d). Red-legged frog (Rana aurora) and western pond turtle (Clemmys marmorata), federal candidates for listing as threatened or endangered species, are known to frequent freshwater wetlands on VAFB. Neither species is expected to occur in the Spring Canyon wetlands because stream flow during the dry summer is insufficient for survival of these species. There is no state or federally listed threatened or endangered species of amphibian or reptile expected or known to frequent the Spring Canyon wetlands.

Riparian Woodland supports many species of resident and migrant birds. Some of the characteristic nesting species in this habitat that are expected to occur near SLC-4 are black-chinned hummingbird (Archilochus alexandri), hairy (Picoides villosus) and downy (P. pubescens) woodpeckers, Nuttall's woodpecker (P. nuttallii), black phoebe (Sayornis nigricans), western wood pewee (Contopus sordidulus), western flycatcher (Empidonax difficilis), Hutton's vireo (Vireo huttoni), warbling vireo (Pheucticus melanocephalus), yellow warbler (Dendroica petechia), common yellowthroat (Geothlypis trichas), black-headed grosbeak (Pheucticus melanocephalus), and song sparrow. Some of the more common winter visitors to Riparian Woodlands include ruby-crowned kinglet (Regulus calendula), hermit thrush (Catharus

guttatus), American robin (Turdus migratorius), yellow-rumped warbler, and pine siskin (Carduelis pinus) (Lehman, 1982).

As a result of the loss and/or alteration of Riparian Woodlands throughout southern California, a number of birds, including yellow-billed cuckoo (Coccyzus americanus), long-eared owl (Asio otis), willow flycatcher (Empidonax traillii), and Wilson's warbler (Wilsonia pucilla), have shown significant population declines over the past century. An additional factor contributing to these declines has been an increase in the population of a brood parasite, the brown-headed cowbird (Molothrus ater). Today, yellow-billed cuckoo, long-eared owl, and willow flycatcher occur in a few isolated locales in north-western Santa Barbara County. Warbling vireo and yellow warbler are local and uncommon nesters in the Riparian Woodlands remaining in Santa Barbara County, including those near SLC-4. All of the above rare species no longer breed south of Point Conception.

Twenty-nine species of mammals are expected to occur in Riparian Woodlands in northern Santa Barbara County (Howald et al., 1985). A total of seven species of small mammals have been recorded in Riparian Woodlands on VAFB (USAF, 1976d). Some of the more abundant small mammals characteristic of this habitat that are expected to occur at SLC-4 include trowbridge and ornate shrews, Botta's pocket gopher, California pocket mouse, deer mouse, brush mouse (Peromyscus boylii), dusky-footed woodrat, and California vole. Riparian Woodlands also provide excellent foraging habitat for a number of large mammals such as brush rabbit, Virginia opossum (Didelphis virginiana), raccoon, long-tailed weasel, striped skunk, bobcat, mule deer, and feral pig. The western gray squirrel is the only regionally rare or declining mammal expected to occur in Riparian Woodlands on VAFB. This species was not found in Spring Canyon during field surveys conducted in October and November of 1986 (Versar, 1987).

Raptors like the red-tailed hawk, American kestrel, barn owl (Tyto alba), and great-horned owl (Bubo virginianus) use Eucalyptus Woodlands in Spring Canyon for roosting and nesting. Common birds associated with Eucalyptus Woodlands and expected to occur near SLC-4 include northern flicker (Colaptes auratus), Nuttall's and acorn (Melanerpes

formicivorus) woodpeckers, Anna's hummingbird, ruby-crowned kinglet, yellow-rumped warbler, dark-eyed junco (Junco hyemalis), house finch, and American goldfinch (Carduelis tristis). Cooper's hawk and western gray squirrel are the only regionally rare or declining wildlife species expected to frequent Eucalyptus Woodlands in the vicinity of SLC-4. There is no threatened or endangered species of wildlife expected to utilize Eucalyptus Woodlands near SLC-4.

E. Ruderal Vegetation

Roadsides, firebreaks, and mowed areas are characterized by many introduced species. Within the existing security fence at SLC-4 and on the terraced portion south of SLC-4 above Spring Canyon, the dominant species is hottentot fig. Narrow-leaved iceplant is also common. Firebreaks at SLC-4 are dominated by annual grasses, narrow-leaved iceplant, sourgrass (Oxalis pes-caprae), mustards (Brassica spp.), veldt grass, and California blackberry. Only the latter species is native. Ruderal vegetation is important in reducing soil erosion in disturbed habitats. Many ruderal species are, however, effective competitors and inhibit the reestablishment of native vegetation. Native vegetation is usually much denser and taller than the low-growing ruderal vegetation and is the preferred habitat of native wildlife.

No Native Grassland habitat is found near SLC-4. There are several areas of Ruderal Grassland that may support wildlife species similar to those found in Native Grassland.

Common reptile species associated with Grasslands and expected to occur near SLC-4 include western skink, western fence lizard, common kingsnake (Lampropeltis getulus), and gopher snake. There is no regionally rare species of reptile expected to frequent Grasslands in the vicinity of SLC-4.

Grassland habitat does not support diverse or abundant amphibian assemblages. Pacific treefrog and California slender salamander are the most common amphibians expected to frequent Grassland habitat near SLC-4. Although Grasslands in other areas of northern Santa Barbara County support populations of two regionally rare and declining amphibians, California tiger salamander (Ambystoma tigrinum

californiense) and western spadefoot toad (Scaphiopus hammondi), neither species has been recorded from VAFB and neither is expected to occur in the vicinity of SLC-4.

Birds associated with Grasslands and expected to occur near SLC-4 include the western meadowlark (Sturnella neglecta), savannah sparrow (Passerculus sandwichensis), American kestrel, and red-tailed hawk. Areas of short grass are favored by horned lark (Eremophila alpestris), water pipit (Anthus spinoletta), and long-billed curlew (Numenius americanus). Tall Grasslands along hillsides between Point Sal and Point Conception are the last habitats in Santa Barbara County known to support sizeable populations of grasshopper sparrows (Ammodramus savannarum) (Lehman, 1982). Grasslands provide essential foraging habitat for a number of regionally rare raptors like the black-shouldered kite, northern harrier, and burrowing owl. All three of these rare species have been recorded in the vicinity of SLC-4.

Common mammals associated with Grasslands and expected to occur near SLC-4 include broad-footed mole (Scapanus latimanus), Botta's pocket gopher, California ground squirrel, western harvest mouse, and California vole (Microtus californicus). Many of these rodents are important prey for hawks, owls, and other carnivores that use Grasslands as primary foraging habitat. The scats, burrows, and tracks of a number of wide-ranging mammalian carnivores including coyote, badger, long-tailed weasel, and striped skunk were found in Grasslands near SLC-4. These Grasslands are also important foraging habitat for mule deer and feral pig (Sus scrofa). The badger is the only regionally rare mammal known to frequent Grasslands in Santa Barbara County. Indications of badger have been observed in Grasslands at SLC-4 (Versar, 1987).

Impacts to Terrestrial Biota

Identification of impacts of the Titan IV program on terrestrial biota focused on implications of construction and operational waste streams of air emissions and water discharges.

Use of the proposed construction overflow area (approximately 100,000 square feet) west of SLC-4W adjacent to Old Surf Road will not result in any significant impact to terrestrial biota. Use of this area

will be restricted to the area previously used as a parking lot. Any use of area outside the boundaries of the previous parking lot would require clearing of dense coastal scrub vegetation, which would be considered an impact to terrestrial biota. Approximately one acre of natural dune scrub habitat will be removed for enlargement of existing Fallback Area 17. This area will be restored after use as a temporary construction area. The impact from areas to be lost from Titan IV construction is not considered significant because the area affected is relatively small in comparison to the size of this community within the project area. Construction and modifications of other Titan IV facilities will occur primarily in previously disturbed areas.

Air emissions discussed in subsection 2.1.2 could cause insignificant, short-term, and localized impacts to terrestrial flora and fauna. Previous studies have shown, however, that predicted operational and catastrophic emissions have not resulted in detrimental effects to biota (USAF, 1986b).

Proposed water discharges or waste streams discussed in subsection 2.1.5 would not cause any significant impact to terrestrial biota.

The occurrence of fire and/or the explosion of a Titan vehicle during operation could result in the loss of some vegetation and wildlife in the SLC-4 area. This impact would be insignificant, based on observations following the Titan explosion of April 1986. In addition, the vegetation at VAFB is susceptible to naturally occurring wildfires. Species in the VAFB area are tolerant to wildfire.

2.1.6.2 Freshwater Biota

A. Water Resource Areas

Seven streams (Canada del Norte, Shuman Creek, San Antonio Creek, Santa Ynez River, Canada Honda Creek, Canada del Jolloru, and Jalama Creek) and five lakes (Mod III, Punchbowl, and Upper, Middle, and Lower Canyon Lakes) constitute the major freshwater resources of the VAFB region (see Figures 2.1.4-4 and 2.1.6-1). Canada Honda Creek is located within 2 miles of the proposed project at SLC-4. The Santa Ynez River, San Antonio Creek, and Shuman Creek are 5.3, 10.7, and 14.0 miles, respectively, from the proposed project at SLC-4.

The freshwater resources of the VAFB region can be divided into four geographic areas. The northern area comprises Canada del Norte, Shuman Canyon, and several seasonal stream drainages. The north-central area includes the San Antonio Creek drainage, the Santa Ynez River drainage north of the river, and several smaller drainages. Because this area contains the main cantonment area of VAFB and highly agriculturized land outside VAFB, it is heavily influenced by human activity. The Santa Ynez Lagoon covers 58 acres in the southwestern corner of this area. The south-central area includes the southern part of the Santa Ynez River drianage, Canada Honda, and several small, seasonal stream drainages. Salinities and nutrient levels are low in comparison with those of the other three areas. The southern area consists primarily of Sudden Ranch and contains small streams and two permanent ponds. The area is lightly to moderately grazed and nutrient levels are between those of the north-central and south-central areas.

B. Freshwater Habitats

The two freshwater habitats closest to the SLC-4 site, Canada Honda Creek and the Santa Ynez River, are discussed below. More detailed descriptions and quantitative data pertaining to other aquatic habitats are available in USAF (1976d).

(1) Santa Ynez River. The Santa Ynez River drains approximately 900 square miles; less than 5 percent of this area is within VAFB. Much of the river is dry during the summer. The combination of a high nutrient level and a low current velocity supports extensive plant growth (such as pondweed, duckweed fern, and watercress) in the river. The invertebrate fauna includes fewer species and individuals (except oligochaete worms at one site) than does the fauna of San Antonio Creek.

The vertebrate fauna of the Santa Ynez River is more populous and diverse than that of any other stream on VAFB. The fish fauna includes mosquito fish (Gambusia affinis), threespine stickleback (Gasterosteus aculeatus microcephalus), bass (Micropterus spp.), bluegill (Lepomis macrochirus), fathead minnow (Pimephales promelas), arroyo chub (Gila orcutti), and tidewater goby (Eucyclogobius newberryi). Anadromous steelhead trout (Salmo gairdneri) once bred abundantly in the upper

reaches of the Santa Ynez River and its tributaries. Now only small numbers of steelhead trout are present when conditions are appropriate. According to a recent study by the U.S. Fish and Wildlife Service, a population of 20 individuals exists at this location (Lompoc Record, 1987). Tree frog (Hyla spp.) and beaver (Castor spp.) also occur along the river.

Santa Ynez Lagoon exhibits great fluctuations in temperature and salinity. Because it is generally brackish, the lagoon commonly supports transient populations of euryhaline marine fish such as starry flounder (Platichthys stellatus), Pacific herring (Clupea harengus), staghorn sculpin (Leptocottus armatus), and tidewater goby.

(2) Canada Honda Creek. This perennial creek is the largest stream on South VAFB. The stream supports dense bank vegetation, but only low densities of green algae, cattail, and tule, except near the ocean where densities are higher. Dominant invertebrates include stonefly, (Plecoptera), caddisfly (Trichoptera), snails, and amphipod crustaceans. The invertebrate fauna of this stream is the most diverse on VAFB and includes at least 25 species. This high diversity is attributable to abundant plant life, clear running water, and year-round flow. The nonintermittent portions of this creek support an introduced population of the Federally-listed endangered unarmored threespine stickleback.

Impacts to Freshwater Biota

Proposed discharges of deluge and washdown water into Spring Canyon have been discussed in subsection 2.1.5.2. Discharges would be limited to the Spring Canyon creek. Speciation, diversity, and abundance in Spring Canyon are already very low, with no fish or other wildlife dependent on the biotic character of the creek for foraging (Versar, 1987). Therefore, no significant impact on freshwater biota is expected from proposed discharges from SLC-4 into the creek. Mitigation of impacts to water quality or beneficial use may be required by the RWQCB in its permitting of these discharges.

2.1.6.3 Marine Biota

Detailed studies of the marine biology of the coastal region from Point Sal to Cojo Bay have been used extensively to characterize

speciation and diversity of the VAFB area (Rodrique et al., 1974, 1976). A summary of these studies is available in USAF (1977a). The discussion presented below is divided into intertidal and subtidal habitats. A brief description of the marine environment adjacent to SLC-4 is provided because of the potential for impacts of the Titan IV project on the coastal marine area.

A. Intertidal Biota

The intertidal zone from Point Sal to Cojo Bay comprises a variety of habitat types, including rocky shores, sandy beaches, and lagoons. North of Point Arguello the biota is generally typical of the central California coast.

In rocky habitats adjacent to SLC-4, the high intertidal zone commonly contains acorn barnacles, periwinkle snails, and limpets; the middle intertidal zone, in addition to these groups, also contains brown and red algae. Slightly lower in the zone are sea anemones, black turban snails, shore crabs, polychaete worms, tidepool sculpins, and green and red algae. Mussels, gooseneck barnacles, starfish, and coralline red algae also are common. The low intertidal zone contains stands of surfgrass and brown and red algae. Turban snails, starfish, and purple sea urchins are common at extreme low-tide levels, as are crabs and giant kelp. Red and black abalone (Haliotus crocherodii and H. rufescens, respectively) also occur in the area.

Sandy beaches alternate with rocky points and bluffs along the coastline. In the sandy habitats, the high intertidal zone often contains amphipod crustaceans associated with drift kelp, while the middle intertidal zone supports sand crabs and polychaete worms. The low intertidal zone contains polychaete worms, razor clams, and Pismo clams. The microscopic interstitial biota of sandy beaches is poorly known, but diatoms, protozoans (especially ciliates), nematode worms, and copepod crustaceans constitute the more common taxa.

Highly exposed rocky points such as Point Arguello support an abundance of intertidal algae, including Fucus distichus, Halosaccion glandiforme, Pelvetiopsis limitata, and well-developed subtidal beds of giant kelp.

Santa Ynez Lagoon, the largest lagoon in the project region, usually supports relatively little phytoplankton. Dominant organisms are invertebrates and include nauplius larvae, as well as isopod (Gnorimosphaeroma lutea) and mysid (Neomysis mercedis) crustaceans.

B. Subtidal Biota

The subtidal region offshore from SLC-4 varies greatly in habitat type and biotic composition. The inshore habitats support a variety of benthic plants, predominantly green and brown algae. The fauna varies with depth. Offshore, at depths of 50 to 75 feet, polychaete worms, speckled sanddabs, and dark-blotched rockfish are dominant. Brittlestars, other starfish, white croakers, yellowtail rockfish, blue rockfish, and pink surfperch dominate at depths of 125 to 150 feet.

(1) Marine Fish. At least 297 species of marine fish occur in the Point Arguello region (USAF, 1977a). The most diverse groups are the surfperch, rockfish, sculpins, clinids, and flatfish.

(2) Marine Reptiles. Three species of sea turtle are the only marine reptiles expected in the project region. Vagrant loggerhead turtles (Caretta caretta), leatherback turtles (Dermochelys coricea; endangered species), and green turtles (Chelonia mydas; threatened species) occasionally occur as far north as the project region.

(3) Marine Birds. A large variety of marine birds occur in the project region. These species include truly oceanic birds, shorebirds, and a variety of species that frequent coastal lagoons. The snowy plover (Charadrius alexandrinus) nests from the Santa Ynez lagoon to approximately 1.5 miles south. The predominant offshore species is the sooty shearwater (Puffinus griseus), which occurs by the tens of thousands throughout the summer and roosts in groups of 100 to 200 individuals.

Forty-three bird species were observed in coastal lagoons around VAFB. Shorebirds and gulls were most abundant. The species that occur year-round include the western gull, ring-billed gull (most abundant species), and ruddy duck. Birds are often abundant near the mouth of Santa Ynez Lagoon. Species that frequent this area include the black turnstone, knot, whimbrel, willet, and a variety of sandpipers. The

mid-lagoon area also supports numerous species including marsh wren, dowitchers, green heron, great blue heron, common egret, least tern, violet-green swallow, and ruddy duck.

Brown pelicans and cormorants are common around Point Arguello, and black oystercatchers nest on the sheer sandstone cliffs. The Point Arguello Boathouse area supports surf scoters, western kingfishers, black oystercatches, and other marine birds. Jalama Beach supports an avifauna similar to that of sandy beaches farther north. Willets and juvenile gulls are common, and sandpipers are often abundant in the small lagoons. Cojo Bay, just east of Point Conception, supports gulls, brown pelicans, cormorants, a variety of shorebirds, and other species.

The California least tern (Sterna albifrons browni), an endangered species, has historically established nesting colonies at the mouths of the Santa Ynez and San Antonio Lagoons and at Purisma Point. The mouths of the lagoons were the only known successful active nest sites on VAFB in 1986 (Foerster, 1987). Data on nesting and foraging activity of the least tern is shown in Table 2.1.6-1.

Another endangered avian species that is commonly observed in the VAFB area is the California brown pelican (Pelecanus occidentalis). The savannah sparrow (Passerculus sandwichensis bryanti) is reported to occur in the Santa Ynez salt marsh. It is not known whether the endangered subspecies Beldings savannah sparrow (P. s. beldingi) also occurs in the VAFB area.

(4) Marine Mammals. A variety of marine mammals occurs in the project region. California sea lions (Zalophus californianus) have been observed on sandy beaches in the project region and harbor seals (Phoca vitulina) are reported to breed on rocky coastal and sandy strand areas at Purisma Point and Rocky Point (Versar, 1987). Harbor seals also haul out along Sudden Ranch on South VAFB, while a few northern elephant seals (Mirounga angustirostris) haul out at Point Arguello (Versar, 1987). Steller sea lions (Eumetopias jubata), California sea lions, northern elephant seals, and northern fur seals (Callorhinus ursinus) have breeding populations at San Miguel Island and may occur sporadically along the coast at VAFB.

Cetaceans (whales, dolphins, porpoises) also occur in the area. Gray whales (Eschrichtius robustus) are probably the most conspicuous species. During the spring and fall, individuals and small groups are frequently seen in the project area.

The project region is within the former breeding range of the southern sea otter (Enhydra lutris nereis), a threatened species, and the Guadalupe fur seal (Arctocephalus townsendi), a rare and threatened species. Neither species is known to breed in the region at this time, but suitable habitat is present. Four sea otters were observed foraging and rafting together off Purisima Point in late summer/fall 1986. This was the first sighting of multiple animals off the coast of VAFB, possibly indicating habitat expansion (Pergler, 1988a).

Impacts to Marine Biota

There would be no air-emission-related impact to marine biota from construction and operation of the proposed Titan IV project. Spill containment areas within the launch complex boundary would prevent the release of spilled propellant into surface water and reduce the possibility of a spill reaching coastal water. The occurrence of a launch- or accident-related ground cloud could have a short-term, localized effect, but any impact would be insignificant. There would be no water discharge into any coastal area and, therefore, no impact to marine biota.

The potential exists for an early inflight termination and the activation of the vehicle destruct system. Due to the hypergolic nature of Aerozine-50 and N_2O_4, most of the propellant released would ignite and burn. A worst-case failure would involve, not only a failure of a Titan IV vehicle near the launch pad, but also the simultaneous failure of the vehicle destruct system, which has never occurred. Under such worst-case conditions, it is possible that some liquid propellant might enter the water. The degree of impact would be dependent on the amount of propellant released and the depth of the water column. Based on a dispersion model for an East Coast Titan IIIC or Titan IIID launch failure, the radius of the contaminated area could vary from approximately 800 to 8,000 feet, depending on the amount of propellant

TABLE 2.1.6-1

NESTING AND FORAGING ACTIVITY OF THE CALIFORNIA
LEAST TERN IN THE VICINITY OF SLC-4
(NUMBER OF INDIVIDUALS)

Location	Distance from SLC-4	1982		1983		1984		1985		1986	
		N[a]	F[b]	N	F	N	F	N	F	N	F
San Antonio Lagoon	11 miles north	6	2	18	12	15-19	NA	13-15	4-5	3	0
Purisma Point	9 miles north	15-20	1	14	9	17-22	NA	0	15-20	0	0
Santa Ynez Lagoon	5 miles north	NA[c]	NA	8	4	NA	NA	NA	NA	8	10

[a] N = Nesting
[b] F = Foraging
[c] NA = Not Applicable
Source: Foerster, 1987.

entering the ocean (USAF, 1975). In the unlikely event of a worst-case flight failure and failure of the vehicle destruct system, localized short-term impacts to water quality and aquatic or marine biota could occur.

2.1.6.4 Channel Islands Biota

The biota of the Channel Islands is generally similar to that of the nearby coast of Santa Barbara and San Luis Obispo Counties. However, notable and significant biologicial differences do occur. Historically, the introduction of pigs, sheep, and cattle has had a devastating impact on parts of the islands, especially in areas that have burned. These species have been responsible for the destruction of much of the native vegetation and for the associated success of many introduced weeds and grasses. Recovery of the native vegetation is occurring where feral sheep have been removed.

Relict populations of species, subspecies, and races persist in isolation from the current centers of their distribution. Other populations are relicts of formerly widespread species that are now extinct or nearly extinct throughout the rest of their former ranges. Still other forms, which developed on the islands, represent variants of mainland forms. The islands represent a unique biological resource.

A. Vegetation and Flora

The vegetation types on the Channel Islands are generally comparable to those on the mainland. They include coastal strand (dune) vegetation, coastal sage scrub, chaparral, oak woodland, coniferous woodland (closed-cone and Torrey pines), riparian woodland, riparian scrub/freshwater marsh, grassland, and planted trees and ornamentals. Chaparral and woodland vegetation are essentially absent from San Miguel and Anacapa Islands. Several endemic species occur only on the islands.

B. Fauna

The faunal communities of the Channel Islands resemble those of similar habitats on the mainland, but fewer species occur in the island habitats. Consequently, individual species often use habitats on the islands that they seldom use on the mainland.

The terrestrial avifauna of the islands generally resembles that of similar habitats on the mainland; however, the Santa Cruz Island jay (a subspecies of the common scrub jay) and several other avian taxa are recognized as subspecies of mainland forms. Oceanic and shorebirds are relatively common on the islands. California's only nesting colony of the endangered brown pelican occurs on West Anacapa Island and in recent years on an islet adjacent to Santa Cruz Island.

The islands include some of the most important California breeding grounds (rookeries) for pinnipeds and migration areas for cetaceans. The distributions of breeding populations of marine mammals and seabirds are shown in Figure 2.1.6-4.

Six pinniped species occur in the Northern Channel Islands. The islands are the northern limit of the Guadalupe fur seal and the southern limit of the Northern fur seal and the Steller sea lion. About three-fourths of the estimated 74,000 seals and sea lions that occur in the Southern California Bight spend at least part of the year in the northern Channel Islands, primarily at San Miguel Island.

In addition to sustaining large pinniped populations, San Miguel Island is the principal seabird rookery of the northern Channel Islands. The world's second largest colony of the ashy storm petrel is found on San Miguel Island, as are nesting populations of the double-crested cormorant, Brandt's cormorant, pelagic cormorant, pigeon guillemot, and Cassin's auklet.

Impacts to Channel Islands Biota

There would be no air-emission-related impact to Channel Islands biota from construction and operation of the proposed Titan IV project. Occurrences of launch- or accident-related ground clouds could have short-term, localized effects on the biota, but these impacts would be insignificant.

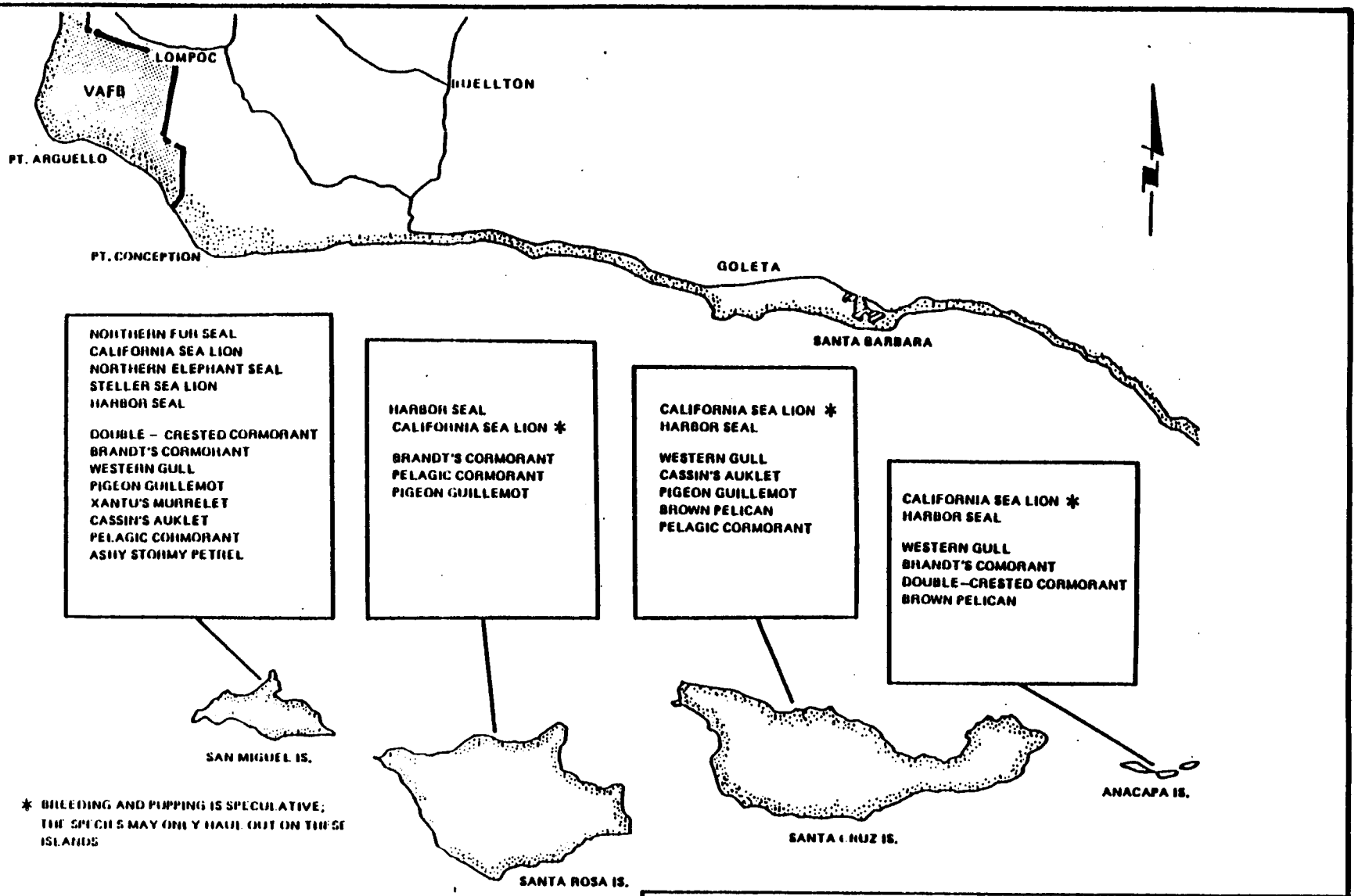
The launching of space launch vehicles generates sonic booms. The magnitude of a sonic boom is a function of the size of the specific vehicle, the extent of its exhaust plume, and its trajectory. As the vehicle ascends and pitches over during flight, the sonic rays converge into what has been called a focused sonic boom that increases the

magnitude of the sonic overpressure. The impact of this focused sonic boom for a specific vehicle is based upon the magnitude of this focusing effect, the location where this focused boom intersects the surface of the earth, the number of launches per year, and the time of year in which they occur.

Space vehicles at VAFB are launched into polar orbit. Certain trajectories take these launch vehicles over or into the vicinity of the California Channel Islands. Depending on the specific trajectory and meteorological conditions (i.e., upper level and surface level wind, temperature, inversions, cloud cover) the certain focused sonic boom will intersect the surface on or near the Channel Islands.

The Channel Islands are important breeding and pupping grounds for a number of protected marine mammals and sea birds. A concern was raised during the environmental impact analysis for the Space Shuttle that the focused sonic boom generated by the Shuttle could impact the breeding success of these species. The concern is associated with evidence which indicates that a focused sonic boom of sufficient magnitude (i.e., 10 lbs per sq ft or greater) could startle marine mammals or sea birds. This would result in burrow collapse and exposure of eggs to avian predators such as gulls, or trampling of marine mammal pups by adults rushing into the water, or separation of pups from their mothers and inability to rejoin after the population had settled down. Such concerns are associated with the breeding success of these species and their implications for long-term impacts on the continuation of the species.

With the assistance of NASA, the Air Force developed a computer model to estimate the magnitude of the sonic booms generated by space launch vehicles. This model estimated that the Space Shuttle sonic boom might be as high as 30 lbs per sq ft. To validate the model, measurements were made of Space Shuttle launches at Kennedy Space Center, Florida. Results showed that sonic booms associated with the Space Shuttle were more realistically expected to fall within the range of 10 to 12 lbs per sq ft. Based upon these realistic levels and extensive research that the Air Force had conducted on the environment of the Channel Islands area and the impact that noise of similar



SOURCE: USAF, 1983a

FIGURE 2.1.6-4

OCCURRENCE OF BREEDING POPULATIONS OF MARINE MAMMALS AND SEA BIRDS ON THE NORTHERN CHANNEL ISLANDS

VANDENBERG AIR FORCE BASE

magnitudes had on marine mammals and sea birds, the Air Force determined that the Space Shuttle sonic boom would not have a significant impact on the Channel Islands. As mandated by the Marine Mammal Protection Act, National Marine Fisheries Service legislation requires the Air Force to make a formal determination that a "take" of protected species will not occur if the Shuttle were launched from VAFB during specified periods. These periods include the sensitive breeding and pupping seasons for species on the Channel Islands.

Specific trajectories for launch of the Titan IV space launch vehicle from VAFB will produce sonic booms that may intersect the surface near or on the Channel Islands. A number of factors indicate that the magnitude of launching the Titan IV vehicle from VAFB is significantly less than the 10 to 12 lbs per sq ft expected from the Shuttle which has already been determined not to have a significant impact on the Channel Islands. These factors include:

- The Titan IV space launch vehicle is smaller than the Shuttle (2/3 of the overall size) and its exhaust plume is significantly smaller than the Shuttle. The physical shape of the Shuttle also affects the magnitude of its predicted sonic boom. Since the magnitude of the sonic boom is directly associated with the size of the vehicle, the size of its exhaust plume, and the shpae of vehicle, the magnitude of the sonic boom associated with the Titan IV space launch vehicle is estimated to be less than the Shuttle.

- The launching of Titan IV from VAFB is a continuation of activities already occuring at VAFB. Over the last 16 years, there have been 27 Titan IIID and Titan 34D space vehicles launched from VAFB. During the more than 150 space launches of various vehicles from VAFB by the government over the last 25 years, there has been no documented impact from sonic booms on or near the Channel Islands or elsewhere. Given the extensive research and time spent on the Channel Islands by research biologists for the Space Shuttle Program, it is likely that they were present on the Channel Islands during a number of these previous launches. No impacts from these launches were reported

and it is unlikely that impacts, if they had occurred, would have gone unreported.

- The research conducted for the Space Shuttle indicates that in any given year there are approximately 100 noise events (aircraft, wave noise, thunder, etc.) on the Channel Islands. It is estimated that 50 percent of these events may be considered major disturbances whereby sound levels reach a magnitude sufficient to cause some type of response from the species of concern. The additional launches of Titan IV vehicles are not considered to be a significant increase over the baseline noise environment.

Based upon the above, it is determined that the sonic booms generated by the Titan IV space launch vehicle program at VAFB will not have a significant impact on or near the Channel Islands (Mason, 1987).

2.1.6.5 Threatened, Endangered, and Special Status Species

The Endangered Species Act of 1973, as amended, is administered jointly by the Department of the Interior, Fish and Wildlife Service (USFWS) and the Department of Commerce, National Marine Fisheries Service (NMFS). Marine mammals (except for the sea otter) are the responsibility of the NMFS, while the USFWS is responsible for plants, birds, reptiles, amphibians, freshwater fish, terrestrial mammals, and the sea otter. Marine turtles and fish are the joint concern of both agencies. The endangered, threatened, or rare status of plant and animal species is federally listed by the USFWS and state-listed by the California Department of Fish and Game (DFG).

Threatened, endangered, and rare species are discussed below by their occurrence in the VAFB project area and in the general project region. The Channel Islands are considered part of the general project region. Appendix A presents consultation letters and responses from USFWS and NMFS for threatened and endangered species potentially affected by the Titan IV program.

Plant and animal species in the SLC-4 area which are listed as threatened, endangered, or otherwise protected by the USFWS, DFG or NMFS are shown in Table 2.1.6-2. Species which are classified as candidates

for endangered or threatened listing are shown in Table 2.1.6-3. Both tables provide an overview of habitat and occurrence of each species in the VAFB project area. A focused description of occurrence will be provided in the Biological Assessment, which is currently being prepared by the Air Force for the Titan II and Titan IV programs. Upon completion, the Biological Assessment shall be submitted to the USFWS for Section 7 Consultation in accordance with Section 7(c) of the Endangered Species Act.

Impacts to Threatened, Endangered, and Special Status Species

There is no documented occurrence of any listed species within the SLC-4 project site. Resident, migrant, or transient listed species could be subject to insignificant short-term, localized impacts from exposure to air emissions or water discharges. There would be no impact to habitat of listed or candidate species from the operation of the proposed project.

Due to its distance from SLC-4, there would be no impact to habitat for the endangered unarmored threespine stickleback, which occurs in Canada Honda Creek.

There would be no significant impact to regionally occurring special status plants and animals or to the rare plants, Castilleja mollis (soft-leaved Indian paint brush) or Scrophularia atrata californica (black-flowered figwort-California figwort hybrid) located on SLC-4 from operation of the proposed project.

Air emissions or a ground cloud could cause insignificant short-term and localized effects on surface-water quality (subsection 2.1.2). There would be no significant impact from air emissions on aquatic biota.

In accordance with Section 7(c) of the Endangered Species Act, the Air Force is preparing a Biological Assessment for endangered and threatened species known or expected to occur in the vicinity of SLC-4E and SLC-4W and other Titan II and Titan IV program-related facilities. This Biological Assessment will address the modifications to the existing structures, construction of new facilities, and subsequent launch operations with regard to their possible effects on threatened

TABLE 2.1.6-2

THREATENED, ENDANGERED AND PROTECTED SPECIES IN THE SLC-4 PROJECT AREA

Common Name	Scientific Name	Status		Habitat	Occurrence/Distance to Project Area	Listed in CNDDB[a]
		Federal	State			
Birds						
Bald eagle	Haliaeetus leucocephalus	E[b]	E	Areas near coasts, rivers, large bodies of water; diurnal perches near food.	Rare winter visitors to Channel Islands; coastal areas from Port Hueneme to Point Conception (ERT, 1984; ES, 1985).	No
California least tern	Sterna albifrons browni	E	E	Foraging habitat includes bays, estuaries, coastal nearshore waters; nesting in sandy or dirt areas along ocean, estuaries, lagoons.	Santa Barbara Channel north to Point Conception (ERT, 1984); up to six breeding pairs at mouth of Santa Ynez River on VAFB (Maydol, 1987; ERT, 1984).	Yes
California brown pelican	Pelecanus occidentalis	E	E	Nests on Channel Islands (primarily Anacapa); forages along southern California coast.	Foraging visitor to entire Southern California coast including VAFB (ERT, 1984); large numbers roost at mouths of Santa Ynez River and San Antonio Creek; a few feed in adjacent lagoons (MMS, 1985).	No
American peregrine falcon	Falco peregrinus anatum	E	E	Nesting restricted to cliffs with ledges or caves 150 ft or more in height; hunting in cropland, meadows, marshes, lakes, rivers.	Migrants along coastal estuaries from Point Conception south; nesting may occur at Gaviota Pass, foraging at Gaviota Creek (ERT, 1984); no nesting at VAFB (Versar, 1987); feeding observed at mouth of Santa Ynez River (MMS, 1985).	No

TABLE 2.1.6-2 (Cont'd)

Common Name	Scientific Name	Status		Habitat	Occurrence/Distance to Project Area	Listed in CNDDB[a]
		Federal	State			
Finback Whale[e]	B. physalus	E	T	Poorly defined migratory patterns in open water; oceanic in nature.	Infrequent sitings in project area (MMS, 1985).	No
Right Whale[e]	Balaena glacialis	E	T	Poorly known; migratory, with some utilization of coastal bays.	Very infrequent in coastal and offshore areas of Southern California; seasonal shift to the south in winter (MMS, 1985).	No
Northern Elephant Seal[b]	Mirounga angustirostris	E	R[f]	Predominant in open sea and rookery island locations in Southern California Bight.	Rookery and haul-out at San Miguel and Santa Barbara Islands.	No
California Sea Lion[e]	Zalophus californianus	P	S	Open sea and rookery island locations in Southern California Bight (SCB).	Entire SCB in summer: rookery islands of San Miguel, Santa Barbara and in Santa Barbara Channel; autumn: move north out of SCB.	No
Harbor Seal[e]	Phoca vitulina	-	-	Open sea and rookery island locations; haul-out at traditional sites.	Haul-out on all northern channel islands and birth at all except, perhaps, Santa Barbara Island.	No
Steller Sea Lion[e]	Eumetopias jubata	Depleted species status review	-	Open sea and rookery island locations; haul-out at traditional sites.	Very infrequent in project area; possibly transient to San Miguel Island or Richardson Rock.	No
Northern Fur Seal[e]	Callorhinus ursinus	Depleted species in North Pacific	-	Open sea and rookery island locations; haul-out at traditional sites.	Within SCB, only comes ashore at San Miguel island and Castle Rock; Channel Islands are southern limit of occurrence.	No
Guadalupe Fur Seal[e]	Arctocephalus townsendi	T	R	Open sea and rookery island locations; haul-out at traditional sites.	Very infrequent in project area; Channel Islands are northern limit of occurrence; no breeding in the Channel Islands.	No

TABLE 2.1.6-2 (Cont'd)

Common Name	Scientific Name	Status		Habitat	Occurrence/Distance to Project Area	Listed in CNDDB[a]
		Federal	State			
Fish						
Unarmored threespine stickleback	Gasterosteus aculeatus williamsoni	E	E	Creeks, associated wetlands.	Critical habitat in San Antonio Creek on North VAFB, particularly in perennially flowing sections (MMS, 1985); introduced to Shuman Creek in 1984; introduced into Canada Honda Creek.	Yes

[a] CNDDB = California Natural Diversity Data Base
[b] E = Endangered
[c] T = Threatened
[d] - = No Listing
[e] Marine mammals protected by the Marine Mammal Protection Act but not included in the NMFS consultation letter (Appendix A).
[f] R = Rare

Source: ES, 1987.

TABLE 2.1.6-3

CANDIDATE SPECIES IN THE SLC-4 PROJECT AREA

Common Name	Scientific Name	Status		Habitat	Occurrence/Distance to Project Area	Listed in CNDDB[a]
		Federal	State			
Plants						
Swamp sand wort	*Arenaria paludicola*	Candidate Category 2		Occasional in swamps and freshwater marshes.	No record of occurrence at VAFB (Pergler, 1987).	No
Hoover's baccharis	*Baccharis plummerae* ssp. *glabrata*	Candidate Category 2		Brushy canyons and mountains near coast, below 1,000 ft; coastal sage scrub.	Documented in San Luis Obispo County; not documented at VAFB (Pergler, 1987).	No
Morning glory	*Calystegia collina* ssp. *venusta*	Candidate Category 2		Unknown.	Unknown.	No
Soft-leaved Indian paintbrush	*Castilleja mollis*	Candidate Category 2		Sand dunes coastal strand, coastal sage scrub.	Point Conception to Pismo Beach, Guadelupe Island; San Antonio Terrace, Pt. Sal, Surf backdunes/within 12 miles of SLC-4.	Yes
Lilac (Nipomo Mesa ceanothus)	*Ceanothus impressus* var. *nipomenis*	Candidate Category 2		Chaparral.	Chaparral and Nipomo Mesa in Santa Maria vicinity/over 20 miles from SLC-4.	No
La Graciosa thistle	*Cirsium loncholepsis*	Candidate Category 2		Brackish and fresh-water marshes.	Pt. Sal, Surf; 2 miles inland from the mouth of Santa Ynez River/6 miles from SLC-4. Was not found on VAFB during intensive field surveys in 1986 (Pergler, 1988a).	Yes
Surf thistle	*Cirsium rhothophilum*	Candidate Category 2		Dunes; coastal strand.	Point Conception to Pismo Beach; largest populations are within VAFB adjacent to Point Arguello; also occurs adjacent to Surf and Purisma Point/within 3 miles of SLC-4.	Yes

TABLE 2.1.6-3 (Cont'd)

Common Name	Scientific Name	Status		Habitat	Occurrence/Distance to Project Area	Listed in CNDDB[a]
		Federal	State			
Beach spectacle-pod	Dithyrea maritima	Candidate Category 2		Coastal strand.	Morro Bay to Los Angeles County; found in most coastal dune systems on VAFB/within 3 miles of SLC-4.	Yes
Lompoc Yerba Santa	Eriodictyon capitatum	Candidate Category 2		Brushy slopes below 1,000 ft; closed cone Bishop pine forest and Burton mesa Chaparral.	Santa Ynez Mountains near Hollister Ranch; northwestern Santa Barbara County; three VAFB sites: two in Pine Canyon, one near intersection of 35th St. and California Avenue/within 10 miles of SLC-4.	Yes
Roderick's fritillary	Fritillaria gravona	Candidate Category 2		Heavy soil on grassy slopes and mesas below 3,000 ft; coastal ranges.	No record of occurrence at VAFB.	No
Crisp Monardella	Monardella crispa	Candidate Category 2		Dunes, back beaches, coastal strand.	Point Arguello north along VAFB coast to Surf and Point Sal.	Yes
San Luis Obispo curly leaved monardella	Monardella undulata var. frutescens	Candidate Category 2		Sandy fields; coastal stabilized, semi-stabilized dunes.	Dunes at Point Arguello north to Santa Maria, inland on San Antonio Terrace.	Yes
Hoffman sanicle	Sanicula Hoffmannii	Candidate Category 2		Coastal sage scrub.	Unknown.	
Black-flowered figwort	Scrophularia atrata	Candidate Category 2		Dry rocky areas of diatomaceous shale, coastal sage scrub, chaparral, willow thickets, riparian corridors, Bishop pine forest, canyons, mesas, roadsides.	South coast of Santa Barbara County to Pt. Sal and San Luis Obispo County; extensive populations on VAFB at San Antonio Terrace, lesser along coast/within 12 miles of SLC-4.	No

TABLE 2.1.6-3 (Cont'd)

Common Name	Scientific Name	Status		Habitat	Occurrence/Distance to Project Area	Listed in CNDDB[a]
		Federal	State			
Invertebrates						
Wandering skipper butterfly	*Panoquina errans*	Candidate Category 2		Coastal sandy strand, dunes; larvae are host-specific to *Distichlis spicata*.	Widespread occurrence from Santa Barbara County strand to Baja, California; no known siting north of Goleta, but potential *Distichlis spicata* habitat occurs at VAFB.	Yes
Morro blue butterfly	*Icaricia icarioides morroensis*	Candidate Category 2		Stabilized back dunes of the narrow coastal corridor.	Northern San Luis Obispo County to its southern extent at VAFB (Pergler, 1988a).	Yes
Globose dune beetle	*Coelus globosus*	Candidate Category 2		Hummocks of native foredune vegetation.	Rare and local along coastal foredune communities from Mendocino County south to Baja, California and the Channel Islands except San Clemente Island.	Yes
Reptiles						
Western pond turtle	*Clemmys marmorata*	Candidate Category 2		Perrennial streams, water bodies.	Occurrence documented at North VAFB in San Antonio Creek, Barka Slough; not found in SLC-4 area.	No
Amphibians						
California red-legged frog	*Rana aurora draytoni*	Candidate Category 2		Perennial ponds, flooded areas, slowly moving streams.	Occurrence at North VAFB in Barka Slough, San Antonio Creek; not found at Spring Canyon (Pergler, 1987).	No
Arroyo toad	*Bufo microscaphus californicus*	Candidate Category 2		Desert regions, washes, streams, arroyos; breeds in brooks and streams, sandy banks with willows, cottonwoods, sycamores.	No documented occurrence at VAFB.	No

TABLE 2.1.6-3 (Cont'd)

Common Name	Scientific Name	Status		Habitat	Occurrence/Distance to Project Area	Listed in CNDDB[a]
		Federal	State			
Mammals						
Spotted bat	*Euderma maculata*	Candidate Category 2		Desert form.	Mainly Arizona, New Mexico, Texas; rare in California; no documentation at VAFB (Collins, 1987).	No
Townsend's western big-eared bat	*Plecotus townsendii townsendii*	Candidate Category 2		Desert form.	No known occurrence at VAFB (Collins, 1987).	No
Western mastiff bat	*Eumops perotis californicus*	Candidate Category 2		Dry land, desert locations; not normally found in coastal or high mountain regions.	No known occurrence in Santa Barbara County (Collins, 1987).	No
Birds						
California black rail	*Laterallus jamaicensis conturniculus*	Candidate Category 2		Pickleweed marshes.	Could occur at Santa Ynez River mouth, but no known occurrence at SLC-4.	No
Western snowy plover	*Charadrius alexandrinus nivosus*	Candidate Category 2		Sandy strand beaches, estuaries.	Abundant nesting and roosting sites at North VAFB, including Shumann Creek, Minuteman Beach, Purisma Point, mouth of Santa Ynez River (Bidstrup, 1987).	No
Long-billed curlew	*Numenius americanus*	Candidate Category 2		Tidal flats; winter: sandy strand; summer: catonment, irrigated grassland.	Common at North VAFB; not documented at South VAFB.	No
White-faced ibis	*Plegadas chihi*	Candidate Category 2		Shallow, marshy, estuarine areas; irrigated fields.	Possible visitor, but not resident at VAFB; observed along southern Santa Barbara County coast (Collins, 1987).	No
Ferruginous hawk	*Buteo regalis*	Candidate Category 2		Open habitat; nesting in Chapparal, grasses, densely wooded areas.	Found at VAFB mostly in winter; no nesting.	No

TABLE 2.1.6-3 (Cont'd)

Common Name	Scientific Name	Status		Habitat	Occurrence/Distance to Project Area	Listed in CNDDB[a]
		Federal	State			
Tricolored blackbird	*Agelaius tricolor*	Candidate Category 2		Diverse riparian habitats with sedges, tules, cattails, marshes.	No occurrence at South VAFB; possible North VAFB sitings.	No
Fish						
Tidewater goby	*Eucyclogobius newberryi*	Candidate Category 2		Shallow coastal lagoons, coastal streams.	San Diego to Del Norte Canyon; at VAFB at mouth of Honda Creek, in Santa Ynez River, and in San Antonio Creek (within 6 miles of SLC-4).	No

[a] CNDDB = California Natural Diversity Data Base

and endangered species. The Biological Assessment will provide greater detail on the potential effects of the program and will be submitted to the USFWS in support of a "No Jeopardy Opinion."

2.1.7 VISUAL RESOURCES

The environs of VAFB offer a variety of aesthetically pleasing vistas, which include rolling hills, floodplains, beaches, and dramatic ocean cliffs.

The only area of extensive development is on North VAFB, while South VAFB is predominantly open space with considerable coastal scenery. Structures on South VAFB include launch facilities, the main thoroughfare (Coast Road), and the Southern Pacific Railroad. Both Coast Road and the railroad run along the coastal perimeter of South VAFB.

Individual launch facilities on South VAFB are, for the most part, concealed from Coast Road. The Titan complex at SLC-4 is momentarily and partially visible while traveling along Coast Road.

The ascent phase of space and ICBM vehicle launches from VAFB are visible from public beaches in the vicinity. Sightings have been reported from as far away as Los Angeles, San Francisco, and Las Vegas. This visual effect is short term and intermittent.

Impacts

The proposed project would consist principally of modifications to existing structures at VAFB and thus will not result in any significant adverse impact to the visual quality of the base. The operational aspects of the program are not expected to significantly reduce the visual character of the area. Launching of Titan II space vehicles will continue to provide intermittent and short-term visual events and will not result in adverse impacts to visual resources of the area.

2.2 MANMADE ENVIRONMENT

2.2.1 POPULATION

2.2.1.1 Demography

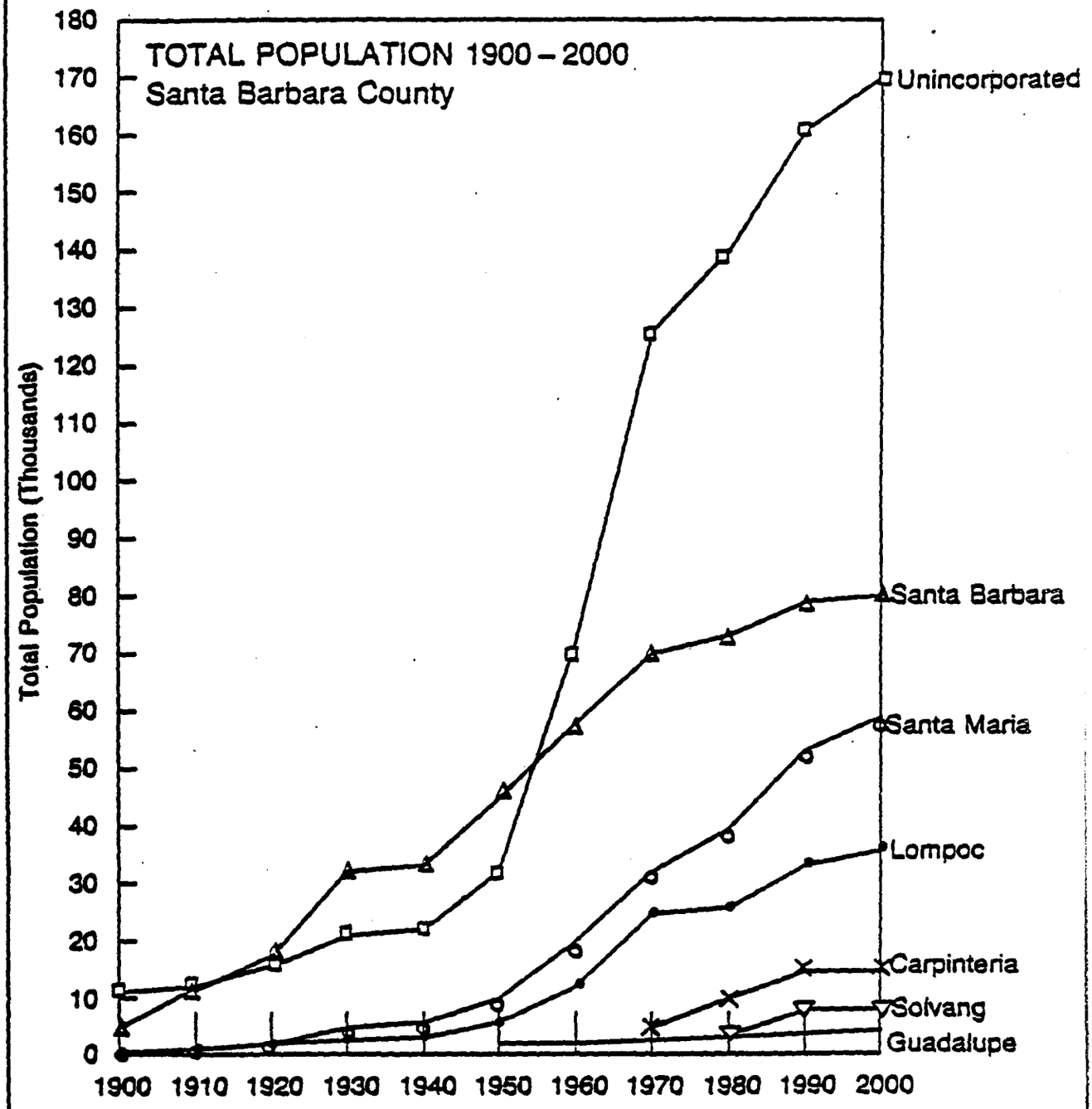
The total population of Santa Barbara County was 298,700 in 1980. The population of Santa Barbara County grew at an average annual rate of 2.1 percent from 1975 to 1980. This population is estimated to have increased to 332,700 in 1985, and should reach over 353,000 by 1990 (Versar, 1987). The population trend of cities in Santa Barbara County is shown on Figure 2.2.1-1.

Activities at VAFB have influenced population growth patterns in Santa Barbara County over the last 30 years, as the regional aerospace industry has grown. The working population at VAFB was 15,016 in 1986, an increase of more than 4,600 over the previous ten years. These figures are down substantially from the mid 1960's, when the VAFB working population was above 18,000. A decrease in the working population at VAFB to approximately 13,800 is projected for 1987 due to the planned phase down of the Space Shuttle Program (Versar, 1987).

The estimated number of construction personnel that will be present for modifications to Titan IV facilities is shown in Table 2.2.1-1. For comparison, the number of operational personnel present during existing or normal (non-launch) operations and launch processing periods is also shown. Except where noted, these figures reflect the projected personnel for both the Titan II and Titan IV programs, because most facilities will be jointly used.

Impacts

Due to the relatively small number of personnel needed for construction and modification of existing facilities (estimated to be 474 additional personnel) and the period of time that the project will be under construction (estimated completion in 8 months), it is not anticipated that the demographic makeup of Santa Barbara County will be significantly impacted. It is anticipated that the labor force for the proposed construction and modifications will be available in nearby Lompoc or Santa Maria.



SOURCE: Santa Barbara County–Cities Area Planning Council, 1985, as included in Versar, 1987

FIGURE 2.2.1-1

POPULATION TRENDS IN SANTA BARBARA COUNTY

TABLE 2.2.1-1

TITAN II/TITAN IV PERSONNEL PROJECTIONS

	Construction	Normal Operations	Launch Operations
NORTH VAFB			
Bldg 8401	25	36	74
Bldg 8337	30	32	32
Bldg 5500	3	40	40
SOUTH VAFB			
SLC-4W	150	160	320
SLC-4E[a]	375	175	350
Bldg 945 and Modular Offices[a]	39	96	50
Bldg 946[a]	50	15	15
SLC-6 (Bldg 398)[a]	10	15	15

[a] To be used for Titan IV program only.

During the operational phase of the project, personnel are anticipated to be drawn from the staff already available at VAFB. The number of personnel required for Titan IV operations is not significantly greater than the current Titan 34D operational staff. No additional employment of personnel is foreseen for operation of the project. No significant change to the demographic characteristics of the VAFB population will result from implementation of this project.

2.2.1.2 Housing

In 1980, the total number of housing units in Santa Barbara County numbered 114,910. Housing that is seasonally vacant, such as beach cottages or other resort facilities, numbered 190 units, resulting in 114,720 year-round housing units. 57,867 units or 50.4 percent of the units were owner occupied, and 51,448 units or 44.9 percent of the total number of housing units were renter occupied (USDC, 1983). Santa BarbaraCounty has a slightly lower percentage of owner occupied housing and a slightly higher percentage of renter occupied housing compared to California, for which owner occupied housing was 52.0 percent and renter

occupied units were 41.0 percent of the total number of housing units (USDC, 1985).

5,465 units or 4.7 percent of the housing units were vacant at the time of the census survey. Of these units, 1,168 units were for sale, most (88.7 percent) for less than 6 months. The median asking price for these units was $97,700. 1,970 units were available for rent, most (75.8 percent) being vacant for less than 2 months. The median asking rental price was $276. 575 units were awaiting occupancy (after being sold or rented), 805 were being held for occasional use, and 947 units vacant for other reasons (USDC, 1983).

Impacts

The housing characteristics of Santa Barbara County are not anticipated to be significantly impacted by the proposed project because no additional permanent personnel are expected to be required as part of the labor force. No additional temporary housing units will be required for construction personnel because they are expected to be coming from the neighboring communities of Lompoc and Santa Maria.

2.2.2 SOCIOECONOMICS

2.2.2.1 Land Use Compatibility

VAFB is located in the northern part of Santa Barbara County and comprises 5.6 percent of the 1,753,370 acres in the county. Land use in the remainder of the county is devoted primarily to the Los Padres National Forest (44 percent), livestock grazing and agricultural cultivation (40 percent), and urban development (about 2 to 3 percent). Urban development in the county is concentrated primarily in the Santa Maria, Cuyama, Lompoc, and Santa Ynez Valleys and the southeast coastal plain (USAF, 1978).

The land along the northern and eastern boundary of VAFB is primarily open space and grazing land. The urban areas closest to the base boundaries in the Santa Maria Valley are: Casmalia, adjacent to the northern boundary of VAFB; Guadalupe, 4.5 miles north of VAFB; and Santa Maria-Orcutt, 2.5 miles northeast of VAFB. The Vandenberg Village-Mission Hills area, which is about 1 mile east of VAFB, and the

City of Lompoc, which is 5.0 miles southeast, form the major urban areas in the Lompoc Valley. One additional population center adjacent to VAFB is the Federal Correctional Institution, which occupies 3,500 acres of land between the VAFB eastern boundary and Vandenberg Village. Large agricultural areas common throughout the region form a buffer between these urban centers and VAFB (USAF, 1978).

Onbase, a central area, referred to as the cantonment area, is dedicated to base support and includes Air Force facilities, contractor areas, and housing and living support. An airfield is located a short distance northwest of the cantonment area, while the remaining southwestern and northwestern areas of the base are dedicated to missile launch facilities. A large portion of VAFB is open space. A right-of-way through the base is allocated to the Southern Pacific Railroad (USAF, 1978).

As described in Section 1.1.1.3, the proposed project consists of construction and modifications to facilities on North and South VAFB.

Impacts

The proposed construction and modifications of VAFB facilities will allow continued use of these facilities for the processing of space vehicles for launching. These sites have been used for similar purposes previously, and thus will not constitute a significant impact on land use compatibility. No significant land use alteration is expected to occur in the remainder of Santa Barbara County due to this project.

2.2.2.2 Community Facilities and Services

A. Potable Water Supply

Santa Barbara County's water resources are derived from approximately 80 percent groundwater and 20 percent surface water sources. An overdraft is occurring in the Lompoc basin, with about 28,550 acre-feet per year being used in 1984 and 24,000 acre-feet per year being the total safe yield (Santa Barbara County, 1985). The total working storage of the Lompoc basin is 300,000 acre feet (USAF, 1987a). An overdraft is also occurring in the San Antonio Valley where current pumpage is approximately 20,000 afy, exceeding the safe yield by approximately 11,000 afy (USAF, 1987a). The working storage capacity of

the San Antonio groundwater basin is estimated to be 500,000 acre-feet (USAF, 1987a).

Most of the VAFB water supply is pumped from groundwater sources via ten wells onbase. In fiscal year 1986, VAFB purchased 9 percent of its water from the Park Water Company (USAF, 1987a). In terms of total pumpage, the main portion of the VAFB supply currently comes from the western portion of the San Antonio aquifer. Approximately 3,400 afy of groundwater is pumped from the San Antonio aquifer, where two new wells were completed in 1977, to provide the majority of North VAFB water requirements.

South VAFB is supplied with water from the Lompoc Terrace aquifer, the eastern portion of the Lompoc basin. This source of water will provide deluge and washdown water for SLC-4. The Lompoc Terrace aquifer is contained almost entirely within the boundaries of VAFB and is, therefore, less subject to withdrawal by other users. This aquifer supplies two wells on base at a combined rate of approximately 350 acre-feet per year, which exceeds the average natural recharge by 100 acre-feet per year. The amount of water in storage above mean sea level is approximately 30,000 acre-feet.

Impacts

The proposed project will increase operational demand on the South VAFB water supply system. Because of the increased size of the Titan IV over the Titan 34D, it is anticipated that a maximum of 170,000 gallons of deluge water per launch may be necessary. This represents an increase of 50,000 gallons per launch over the amount for each Titan 34D launch. However, because there will be only 4 launches per year, an increase of 200,000 gallons per year over the total amount historically used each year does not represent a significant impact to the water supply.

This additional demand may result in the increased drawdown of the Lompoc Terrace aquifer. While this impact will not be significant in the short-term due to the large amount of storage, long-term impacts could result from the lowering of the water table. Although the Lompoc Terrace aquifer is not considered a long-term source of water (USAF,

1987a), the projected increase in water use for the Titan IV program relative to current use by VAFB is not expected to result in a significant impact to the long-term water supply.

The proposed project is not anticipated to increase water demand beyond its current usage at North VAFB and subsequently the San Antonio aquifer. However, the present demand may result in the continued drawdown of the San Antonio aquifer. The adjudication of groundwater resources in San Antonio valley has been considered. This may reduce groundwater supplies to North VAFB (USAF, 1987a). VAFB is evaluating water supply alternatives such as the State Water Project, dam and reservoir projects, water conservation, and conjunctive use.

B. Wastewater Treatment and Disposal

Wastewater treatment facilities in the immediate area include city-owned plants in Lompoc and Santa Maria, government-owned plants on VAFB and at the Federal Correctional Institution, and onsite package treatment plants serving remote areas of VAFB.

Sewage from the cantonment area of North VAFB is transported to the regional wastewater treatment facility in Lompoc. The facility provides secondary treatment and nitrification and has a capacity of 5 million gallons per day. Vandenberg Village is connected to the Lompoc system. The Federal Correctional Institution in Lompoc uses a separate secondary treatment system, which has a 0.3 million gallons per day design capacity to serve a maximum of 2,350 people. No future expansion of this system is anticipated.

Because of the remoteness of SLC-4, sanitary waste from the complex is treated at an onsite package sewage treatment plant. This plant has a maximum capacity of 15,000 gallons per day and is currently running at 9,000 to 11,500 gallons per day. Waste from this plant goes to evaporation/percolation ponds located northwest of SLC-4E near Bldg 743. Because the existing STP has periodically been in non-conformance with standards for 5-day BOD and suspended solids, a replacement STP will be built by 1990, possibly sooner, to adequately dispose of sewage from SLC-4.

A small sewage discharge from the RIS modular offices will be handled through a septic tank-leach field system.

Impacts

The proposed project will result in additional wastewater generated at the new MST Air Conditioning building at SLC-4E. The wastewater will result from condensation from precooling coils, reverse osmosis, water softening, and boiler blowdown. It has been estimated that these processes may generate approximately 1,200 gal/day which will be discharged into the SLC-4E STP. The additional wastewater will not impact the existing system.

C. Solid Waste Collection and Disposal

VAFB has a sanitary landfill onbase. To preserve the area's aesthetic value, this landfill is located in a canyon head to prevent wind scattering of material by the landfill and extensive road paving to control dust. Onbase waste control also includes three incinerators, a recycling program, and a building disposal program (USAF, 1980).

Impacts

During the construction phase of the project, a higher amount of solid waste may be generated. This additional waste generation is expected to be a short-term impact and the amount of solid waste generated should return to normal during the operational phase of the project. No significant adverse impact on sanitary landfills in Santa Barbara County or at VAFB is expected as a result of this project.

D. Energy

The Southern California Gas Company provides natural gas to both the North County and South Coast areas and will be able to meet existing and new demands. VAFB is supplied through a 6-in. gas main. The current use rate is about 750,000 million cubic feet per year, 15 percent less than the contracted supply rate of 885,500 million cubic feet per year (USAF, 1980).

The North County is included within Pacific Gas and Electric's service area. No problem is expected in rendering service. Power from the Morro Bay plant is transmitted to a single metering point near

VAFB's main substations. VAFB owns its internal distribution system. While existing commercial capacity is adequate to meet current demand, the base maintains five diesel-powered generating plants to support various technical facilities (USAF, 1980).

The USAF is constructing a new power plant on South VAFB. The power plant will provide up to 15 megawatts of power, of which up to 3 megawatts will be available to SLC-3 and SLC-4. This power plant will use natural gas as its primary power source. A new natural gas pipeline will be installed on South VAFB to provide gas for the power plant. Details of this project are addressed in a separate environmental assessment (USAF, 1985).

Impacts

Energy requirements for the operation of the proposed Titan IV project are not anticipated to exceed current or past usage. It is not expected that the proposed project will require the construction of any additional power-generating facilities or significantly deplete the unused energy capacity of any existing plant.

E. Police Service

All police services for VAFB are provided by the Air Force, which has cooperative aid agreements with local police departments.

Impacts

The proposed project will create no new permanent employment on VAFB or in Santa Barbara County. No expansion or other significant change to the base or local police departments will be necessary because no population increase will result from implementation of this project.

F. Fire Protection

All fire protection services for VAFB are provided by the Air Force. The base fire department has mutual aid agreements with local fire districts.

Impacts

The fire protection needs of the proposed facilities are not expected to be greater than present. No additional personnel or equipment are expected to be required as a result of this project.

G. Health Services

Santa Barbara County has many medical resources to support its residents including two hospitals in the Santa Maria area and one hospital in Lompoc. VAFB has a 40-bed hospital and outpatient treatment facilities (USAF, 1987a).

Impacts

No additional permanent employment or population would result from this project. No need for increased medical personnel or expanded medical facilities is expected on VAFB or in Santa Barbara County as a result of this project.

H. Educational Facilities

In October, 1979, the County of Santa Barbara had a public school enrollment of 48,740 students, which is well below the 1970 peak enrollment of 61,818 students and down from the 54,459 students enrolled in the fall of 1977 and 50,491 students enrolled in 1978. 20,720 of the students were enrolled in elementary school districts and 28,020 in unified and secondary schools. With 2,675.5 teachers, there was a student-to-teacher ratio of 18:1. The county also had 31 parochial and private or special schools with the 1976 enrollment totaling 5,300 students (USAF, 1980).

There are several institutions of higher learning in the county. The largest is the University of California at Santa Barbara with a third-quarter enrollment in 1979 of 14,250 students. Westmont College had a reported enrollment of 937 students in the fall of 1979. There were 8,114 students enrolled at Santa Barbara City College in the fall of 1979 and 8,236 enrolled at Hancock College in Santa Maria (USAF, 1980).

Impacts

No increase in permanent employment is anticipated as a result of this project, and thus no increase in school-age children. The need to increase the number of teachers or expand educational facilities is not expected.

I. Recreation

Community parks, public beaches, golf courses, and wilderness areas are all found within the immediate vicinity of VAFB. Recreational activities at these facilities include swimming, boating, surfing, surf fishing, hiking, biking, camping, barbecuing, field sports, golfing, picnicking, and horseback riding (USAF, 1980). Ocean Beach Park, Jalama Beach Park and Point Sal are public beaches located in the immediate vicinity of VAFB. Recreational areas located on VAFB are open to active and retired military personnel and not available to the general public.

No additional population is expected to relocate into the area as a result of this project. Use of recreational facilities both on- and offbase is not likely to increase.

Impacts

Historically, Surf Beach, Ocean Beach Park, and Jalama Beach Park have been evacuated during certain space vehicle launches from VAFB. These beaches will continue to be evacuated, depending on the specific launch azimuths, for launches of the Titan IV space vehicle. This not a new requirement and the Air Force has evacuation agreements in force with the State and County. This action will not significantly impact recreational resources.

Due to the similarity of proposed and existing land uses, operation of Titan IV facilities is not expected to significantly impact the enjoyment or availability of recreational resources.

2.2.2.3 Transportation

A. Highways

Highways in the vicinity of VAFB includes State Highways 1, 135, and 246.

Highway 1 generally proceeds in a north-south direction in the VAFB area. Traffic volumes on Highway 1 at a location north of Jalama Road are 460 vehicles for the peak hour and 5,300 vehicles for the peak-month average day. Volumes increase east of the Highway 1 junction with Highway 246 (also known as Ocean Avenue), with a peak-hour traffic volume of 1,150 vehicles and a peak-month average daily traffic of 15,000 vehicles. Traffic also increases west of this junction, with a peak-hour traffic volume of 1,500 vehicles and a peak-month average daily traffic volume of 17,200 vehicles. At the location where Highway 1 crosses the Santa Ynez River, the peak-hour traffic volume is 2,800 vehicles and the peak month average daily traffic volume is 31,500 vehicles. Much of this traffic is probably accessing Lompoc via Lompoc-Casmalia Road, because north of the intersection of Lompoc-Casmalia Road with Cabrillo Highway (on Cabrillo Highway), the peak-hour traffic volume is 500 vehicles and the peak-month average daily traffic volume is 5,800 vehicles. Highway 1 also receives a large amount of traffic from Vandenberg Road, because south of the intersection of Highway 1 with Vandenberg Road, the peak-hour traffic volume is 270 vehicles and the peak-month average daily traffic volume is 3,050 vehicles. North of this intersection, the peak-hour traffic volume is 2,300 vehicles and the peak-month average daily traffic volume is 20,100 vehicles (Caltrans, 1985).

Highway 246 generally proceeds in an east-west direction to VAFB and bisects the base into North and South VAFB. The traffic volume on Highway 246 in the Surf area during the peak hour is 430 vehicles and the peak-month average daily traffic volume at this location is 3,900 vehicles. Southeast of Arguello Boulevard, the peak-hour traffic volume is 690 vehicles and the peak-month average daily traffic volume is 4,850 vehicles. Southeast of Leege Road the peak-hour traffic volume is 740 vehicles and the peak-month average daily traffic volume is 5,700 vehicles. As Highway 246 approaches Highway 1, it passes through Lompoc, increasing its peak-hour traffic volume to 1,550 vehicles and the peak-month average daily traffic to 14,600 vehicles (Caltrans, 1985).

Highway 135 in the VAFB area generally proceeds in a northwesterly direction to southeast. Although Highway 135 does not approach VAFB as closely as Highways 1 and 246, it serves the function of connecting Los Alamos to Santa Maria while bypassing the VAFB area. South of its intersection with Highway 1 in Harriston, the peak-hour traffic volume is 110 vehicles and the peak-month average daily traffic volume is 1,050 vehicles. North of its junction with Highway 1, the peak-hour traffic volume is 1,750 vehicles and the peak-month average daily traffic volume is 13,900 vehicles (Caltrans, 1985).

Roadways in the VAFB area are generally at Level of Service C (stable flow but maneuverability limited by high volume) or better, except in a limited number of locations. One such location is that section of Highway 1 known as H Street in downtown Lompoc. This section frequently operates at Level of Service D (approaching unstable flow, affected by fluctuating high traffic volume) during peak traffic periods (USAF, 1980).

Impacts

No additional permanent employment is expected to occur as a result of this project. No additional traffic will be generated by an increase in population on or in the vicinity of VAFB.

Additional traffic is likely to occur during the construction phase of the project. However, this increase in traffic will be temporary.

Rocket propellant is manufactured in the state of Mississippi and transported along public roads to VAFB. During the operational phase of the Titan IV project, it is estimated that five fuel trucks and nine trucks carrying oxidizer will be needed prior to a launch. Since the 1960s, these propellants have been delivered to VAFB in support of ongoing Titan, Atlas, and other launch programs. These trucks currently enter VAFB from Highway 246 through the 13th Street gate. The Department of Defense is currently reevaluating transportation routes to VAFB in consultation with the State of California. The additional number of propellant trucks required for the Titan IV project will not significantly impact the existing traffic volume. Highway traffic is not expected to be significantly impacted.

B. Rail

Three railroads provide service in the vicinity of VAFB: the Southern Pacific, Santa Maria Valley, and Ventura County Railroads. The Southern Pacific Transportation Company line serves as the main line of the Los Angeles-to-San Francisco coastal rail transportation corridor. Freight service is provided to most of the cities along the coast. AMTRAK passenger service is available in Oxnard, Santa Barbara, and San Luis Obispo (USAF, 1978).

Three branch lines at VAFB connect to the Southern Pacific main line. The Ventura County Railroad connects the Southern Pacific main line in Oxnard with the harbor facility at Port Hueneme. The Santa Maria Valley Railroad connects the Southern Pacific main line to the Santa Maria Valley (USAF, 1978).

On VAFB, Southern Pacific tracks pass between the launch facilities and the ocean and are therefore overflown during all launches. To minimize the potential risk to people and property, trains are not subject to overflights. An electronic surveillance system, posted schedules, and close coordination including radio communication between train engineers and VAFB launch personnel are used to minimize the possibility of an overflight (USAF, 1978).

Impacts

No additional requirement for the use of railroad equipment or facilities during the construction and operation phases of the proposed project is anticipated over that currently occuring for Titan 34D operations. No adverse impact is expected.

C. Air Transportation

There are seven active airports in the vicinity of VAFB: Santa Barbara Municipal, Santa Ynez, Lompoc, and Santa Maria Public Airports, Ventura County Airport at Oxnard, Point Mugu Naval Air Station, and VAFB. Flight operations include jet air carriers, air taxis, and military aircraft, but the vast majority of operators are general aviators. It should be noted that the Lompoc and Santa Ynez Airports do

not provide scheduled commercial air service and Point Mugu Naval Air Station is used only by military traffic (USAF, 1978).

Impacts

No additional permanent employment is expected to result from this project. No additional use of commercial service due to an increase in population in the vicinity of VAFB is expected.

VAFB has been and is currently being used to launch space vehicles. The proposed project would continue to use VAFB for this purpose. No adverse impact is expected to result from the use of VAFB for the proposed launch operations.

D. Marine Transportation

The major operational harbor in the region is Port Hueneme, which is the fourth largest harbor in Southern California (by traffic volume). However, most of the commercial vessel traffic in the Santa Barbara Channel is from Los Angeles and Long Beach Harbors; only a small proportion of this traffic is contributed by Port Heuneme (Chambers, 1986). Traffic passes through the channel at a rate of one ship per hour (Chambers, 1986).

A harbor facility at Point Arguello on South VAFB was constructed for the Space Shuttle Program in 1983. This facility is not in use and there is no plan to use this facility for the Titan IV program.

Current space and missile operations at VAFB require the designation of danger zones. Marine traffic is advised by radio broadcasts, announcements in the Notice to Mariners, current status announcements at local harbors, and sea and air patrols to avoid these danger zones. Launches are programmed to confine potentially dangerous debris to the danger zones, although some debris may fall outside the designated areas (USAF, 1978).

Impacts

No additional marine traffic is expected to be generated by the proposed project. Safety measures, such as those described to warn mariners of danger zones, will continue to be used to minimize hazards

to marine traffic. No significant impact to marine traffic is expected as a result of this project.

2.2.2.4 Economy

In 1984, the total population in Santa Barbara County was 320,400. Of this, the total labor force numbered 173,539 people. At that time, 152,459 people were employed and the unemployment rate was 5.9 percent (USAF, 1987a).

Table 2.2.2-1 presents a comparison between the annual household income distributions for California and Santa Barbara County. Generally, Santa Barbara County has a higher percentage of its population in the $5,000 to $19,999 income categories, but has a lower representation in the $20,000 to $49,999 income categories. This distribution has resulted in a slightly lower median household income for the county compared to that for all of California, but has also resulted in a slightly higher mean household income.

Impacts

The construction/modification phase of the project will have a short-term beneficial impact on local economy. However, the operational phase of the project will have no impact because the personnel to be used for this phase will come from existing VAFB staff. No new permanent employment will result from implementation of the proposed project.

2.2.3 HAZARDOUS WASTE

The Titan IV space launch vehicle program at VAFB will generate hazardous waste in excess of previous quantities from the Titan 34D program. Waste products will consist of paint, solvent, adhesive, alcohol, lubricant, oil, grease, fuel, propellant, deluge/washdown water, contaminated rags, and process chemicals.

Waste stream projections at SLC-4 for the Titan II/Titan IV programs are based on requirements 2.1 times greater than the previous Titan program (MMC, 1987c). This multiplier applies to all hazardous material, with the exception of propellant. A preliminary estimate of hazardous waste streams to be generated at SLC-4E and by processing

TABLE 2.2.2-1

ANNUAL HOUSEHOLD INCOME DISTRIBUTION FOR SANTA BARBARA COUNTY

	Distribution			
Household Income	California	Percent	Santa Barbara County	Percent
Total Households	8,644,633	100.0	109,357	100.0
Less than $ 5,000	990,668	11.4	11,652	10.7
$ 5,000 to $ 7,499	626,187	7.2	8,205	7.5
$ 7,500 to $ 9,999	653,789	7.6	9,025	8.2
$10,000 to $14,999	1,279,524	14.8	16,928	15.5
$15,000 to $19,999	1,146,437	13.3	14,620	13.4
$20,000 to $24,999	1,045,319	12.1	13,099	12.0
$25,000 to $34,999	1,429,229	16.5	17,850	16.3
$35,000 to $49,999	923,669	10.7	10,838	9.9
$50,000 or more	549,811	6.4	7,140	6.5
Median	$18,243	---	$17,962	---
Mean	$22,416	---	$22,498	---

Source: USDC, 1983 and 1985.

facilities common to both the Titan II and Titan IV programs is provided in Appendix B. Waste stream flow changes for SLC-4W were reported in the Titan II Environmental Assessment (ES, 1987). Hazardous waste quantities shown in Appendix B are based on a maximum of three Titan II and two Titan IV launches per year.

Hazardous waste for the Titan IV program will be generated on South VAFB at Bldgs 715 (at SLC-4E), 945, 946, and 398; and on North VAFB at Bldgs 8337, 8401 and 9325.

The estimated Titan IV hazardous waste stream flow changes at SLC-4E are provided in Table B-1. Existing waste generated at Bldgs 715 and 725 for the Titan 34D Program at SLC-4E are shown in Table B-2 and are expected to continue until Titan 34D operations are completed.

Waste products from Bldg 945 are identified in Table B-3. Quantities of existing and projected wastes from Bldg 945 are not available. No significant waste stream changes at Bldg 945 are projected for the Titan IV program.

Since the summer of 1986, approximately 2,500 gallons per month of silver/water solution has been produced at Bldg 946. An increase to 3,500 gallons per month is expected to occur due to Titan IV SRM processing. The silver in this solution is reclaimed and reused. The remaining water solution is then sampled, treated if necessary, and disposed of in the sewer system.

No hazardous waste is currently produced at Bldg 8337 (PLF Processing and Storage Bldg). The projected Titan II and Titan IV waste generation for Bldg 8337 is provided in Table B-4.

The changes in the current waste streams for the Titan III program at Bldg 8401 are shown in Table B-5 and are expected to roughly double for the Titan II and Titan IV programs. The theoretical operating waste streams for the projected Core Vehicle Assembly Bldg portion of Bldg 8401 are also shown in Table B-5.

Bldg 9325 (Construction and Manufacturing Auxiliary Bldg) presently provides many maintenance shop functions for North and South VAFB. Existing waste production at Bldg 9325 is shown in Table B-6. Hazardous waste from this facility is expected to increase by a factor of about two to support the Titan II and Titan IV programs. This additional waste is quantified in Table B-6. Should additional program-related maintenance occur at some other facility, that waste would be directed to a Hazardous Waste Collection Accumulation Point (CAP).

All Titan IV hazardous waste will be processed through the existing VAFB system which utilizes CAPs. The USAF Space Division has consolidated CAP locations on VAFB. One CAP is located on North VAFB and one on South VAFB. After hazardous waste is identified, containerized, and documented at the origination point, it is transported within 90 days to Bldg 3300, which is the Hazardous Waste Storage Facility (HWSF) located at New Mexico and 33rd Streets on North VAFB. The HWSF is operated by the Defense Logistics Agency (DLA). This facility is authorized to operate under a State Hazardous Waste Facility Permit issued by the California Department of Health Services. DLA personnel use licensed hazardous waste carriers and disposal firms under

contract to the DLA for offbase transport and disposal of hazardous waste from VAFB (USAF, 1986e).

As part of the state hazardous waste facility permit, VAFB has adopted an Operation Plan that includes contingency procedures for emergency situations.

The Air Force has developed a comprehensive hazardous waste minimization program which is based on product substitution, waste recycling, and on-site treatment where feasible. The Titan IV program is being evaluated under this minimization program and measures to reduce the generation of hazardous waste will be implemented where feasible.

Impacts

Because of the hazardous waste handling procedures currently being carried out by VAFB, the proposed Titan IV program is not expected to result in any adverse impact from hazardous waste.

2.2.4 SAFETY

Safety of space launch vehicle programs is required by the military System Safety Program Plan, which assures compliance with federal, state, and Air Force Occupational Safety and Health regulations. Safety regulations that govern siting of launch facilities on the base include restrictions on use of launch safety zones and explosives. Safety reviews are conducted for each program and documented in an Accident Risk Assessment Report. This report is applicable to the launch vehicle, payload, support equipment, and facilities. It also provides the means of substantiating compliance with program safety requirements and summarizes all system safety analyses and testing as required by USAF and DOD. A detailed range safety certification must be completed 6 months before initial launch capability. It is expected that the Titan IV program will be certified at the same risk factor as the previous Titan 34D program.

The safety aspects of the Titan IV program are described in the preliminary Integrated Accident Risk Assessment Report (MMC, 1987e). Titan IV operations that require special attention due to hazard

potential have been identified as safety critical operations. The risk associated with the Titan IV program at VAFB has been determined to be acceptable at this point in the program. No safety issues have been identified for which resolutions are not anticipated. Risk associated with the core vehicle, solid rocket motors, payload fairing, liquid rocket engines, avionics elements, facilities and Aerospace Ground Equipment (AGE) is the same, comparable to, or reduced from that of previous Titan vehicles and does not represent any change in safety. Facility and ground equipment modifications are not expected to introduce unreasonable risk.

Potential hazards associated with the Titan IV launch vehicle programs are listed in Table 2.2.4-1. The levels of exposure to hazardous material (expressed in quantities) during Titan IV operations are shown in Table 2.2.4-2.

The Titan IV program will also involve exposure to ordnance systems, hydraulic fluid, and various manufacturing material, such as paint, solvent, and alcohol. Ordnance checkout and installation involves the handling, transporting, installing, and removing of ordnance devices, checking such devices as engine-start cartridges, explosive bolts, retro-rocket motors, and vehicle destruct systems. Additional discussion of hazardous waste is presented in Section 2.2.3.

Two Titan 34D launches from SLC-4E were failures. Neither incident resulted in personnel injury. The August 1985 launch did not attain the proper orbit because one of two core vehicle engines shut down. The vehicle was destroyed at high altitude through the automatic destruct command.

The Titan 34D launch from SLC-4E in April 1986, which resulted in an explosion and vehicle failure, was caused by a weak bond between insulation material within the solid rocket motor (AW&ST, 1986). Debris from the solid propellant ignited ground fires within 0.5 mile of the launch area. Smoke generation resulted in a ground cloud that moved in a southeasterly direction. The solid propellant emits hydrogen chloride and aluminum oxide when burned, but in smaller quantities than a Space

TABLE 2.2.4-1

POTENTIAL HAZARDS OF TITAN IV PROGRAM

Hazard	Source
Fire and Explosion	Fuels (liquid and solid)
Pressure	Pneumatics, Hydraulics
Structural Failure	Structures, Pressure Systems, Mechanisms
Electrical/Electronics	Power Systems, Electronics, Batteries
Collision	Transport, Material Handling
Detonations	Ordnance
Toxics/Asphyxiants	Propellants, Solvents, GN_2
Corrosion	Propellants, Environments
Stress	Materials, Loads
Acceleration	Transport, Material Handling
Shock (Mechanical)	Ordnance, Material Handling
Human Factors	Operating Errors

TABLE 2.2.4-2

LEVELS OF EXPOSURE TO HAZARDOUS MATERIAL
DURING TITAN IV OPERATIONS

Material	Titan IV Quantity (lb)
Stage Zero (solid)	1,183,384
Stage I Propellant (liquid)	
Fuel (Aerozine-50)	120,638
Oxidizer (N_2O_4)	230,195
Stage II Propellant (liquid)	
Fuel (Aerozine-50)	28,363
Oxidizer (N_2O_4)	50,681
Thrust Vector Control System (N_2H_4)	16,848
Electrical Power System Batteries	(Silver Zinc)

Shuttle launch. Numerous investigations of the explosion found that no damage to human, animal, or plant life occurred (USAF, 1986b).

Other possible incidents that could cause injury or damage include oil/propellant spills and the hazardous effects of a persistent post-launch ground cloud. However, pre-launch meteorological monitoring and launch constraints minimize the potential for such occurrences.

Design of the launch pad includes spill containment structures as shown in Table 2.1.5-4. In the event of an oil spill, procedures of the VAFB Spill Prevention Control and Countermeasure (SPCC) Plan will be followed. Spills of propellant (i.e., hydrazine or nitrogen tetroxide) will be confined within propellant handling areas. All propellant handling operations are conducted in closed systems. In the event of a propellant spill, exposure level in excess of recommended safe level would result for only a short time because the propellant would evaporate rapidly. Because hydrazine is an industrial substance suspected of inducing cancer in humans, special precautions are taken to ensure safe handling.

The possibility of a persistent exhaust ground cloud at the time of launch is reduced by pre-launch meteorological monitoring and the resulting decision to launch, as discussed in subsection 2.1.1.3.

VAFB operates under an operational emergency contingency plan developed by the Western Space and Missile Center. The plan delineates the roles and responsibilities of Base personnel in the event of any emergency.

VAFB is currently reviewing plans and procedures for response to spills of oil and hazardous substances. This review will result in revisions to the Spill Prevention Control and Countermeasure (SPCC) Plan which integrates base plans for emergency response.

Impacts

Because of safety and disaster planning and preparedness aspects of the Titan IV program, it is not expected that modification activities and operations at SLC-4E will result in the introduction of any unreasonable risk that may result in a hazard to which local response groups cannot adequately respond.

2.2.5 NOISE

Ambient and project-generated noise levels are discussed in this section.

2.2.5.1 Noise

Noise is most often defined as unwanted sound. Sound levels can be easily measured, but the variability in subjective and physical response to sound complicates the analysis of its impact on people. People judge the relative magnitude of sound sensation in subjective terms such as "loudness" or "noisiness." Physically, sound pressure magnitude is measured and quantified in terms of a level scale in units of decibels (dB).

The human hearing system is not equally sensitive to sound at all frequencies. Because of this variability, a frequency-dependent adjustment called the A-weighting has been devised so that sound may be measured in a manner similar to the way the human hearing system responds. The use of the A-weighted sound level is often indicated by using the abbreviation "dBA" for expressing the units of the sound level quantities. Typical A-weighted noise levels measured for various sources are provided in Figure 2.2.5-1. When sound levels are read and recorded at distinct intervals over a period of time, they indicate the statistical distribution of the overall sound level in a community during the measurement period. The most common parameter derived from such measurements is the energy equivalent sound level (L_{eq}). L_{eq} is a single-number noise descriptor that represents the average sound level in a real environment where the actual noise level varies with time.

While the A-weighted scale is often used to quantify the sound level of an individual event and is related to subjective response, psychoacousticians (scientists specializing in the effects of noise on people) have determined that the degree of annoyance response and other effects depend on a number of factors. Some of the factors identified by researchers over the years that affect our perception and cause us to categorize a sound as an annoyance or, in other words, as noise are:

- magnitude of the event sound level in relation to the background (i.e., ambient) sound level;
- duration of the sound event;
- frequency of occurrence of events; and
- time of day events occur.

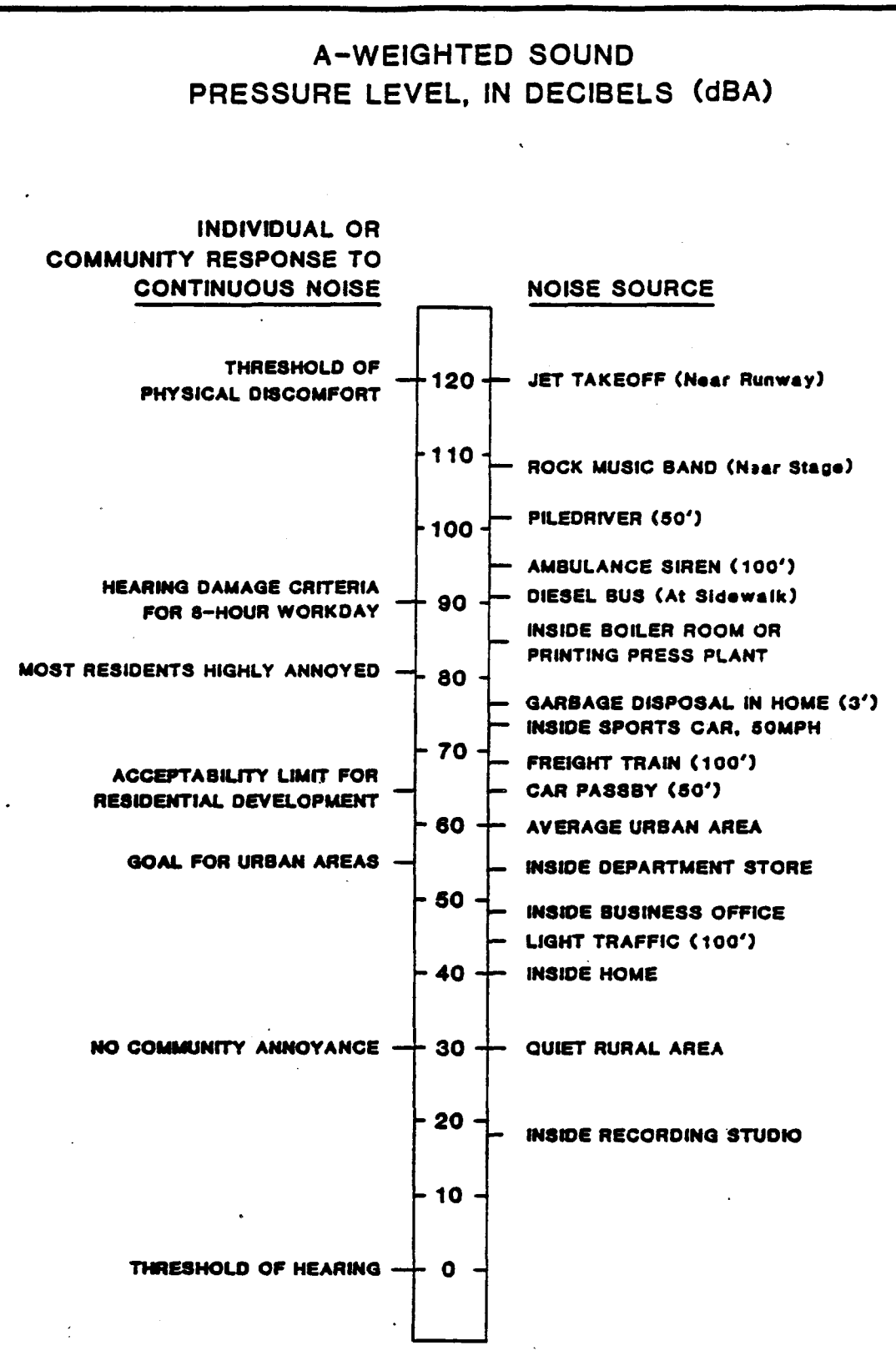


FIGURE 2.2.5-1

TYPICAL SOUND LEVELS FROM INDOOR AND OUTDOOR NOISE SOURCES AND THEIR EFFECT ON PEOPLE

Several methods have been devised to relate noise exposure over time to community response. The Environmental Protection Agency (EPA) has developed the Day-Night Average sound level (L_{dn}) as the rating method to describe long-term annoyance from environmental noise. L_{dn} is similar to a 24-hour L_{eq} A-weighted, but with a 10 dB penalty for nighttime (10 p.m. to 7 a.m.) sound levels to account for the increased annoyance that is generally felt during normal sleep hours. The Air Force also uses L_{dn} for evaluating community noise impact.

The Community Noise Equivalent Level (CNEL) has been adopted by the State of California for environmental noise monitoring purposes. CNEL is also similar to the A-weighted L_{eq}, but includes a penalty of 5 dB during evening hours (7 p.m. to 10 p.m.), while nighttime hours (10 p.m. to 7 a.m.) are penalized by 10 dB. For outdoor noise, the L_{dn} noise descriptor is usually 0.5 to 1 dB less than CNEL in a given environment.

The federal and state governments have established noise guidelines and regulations for the purpose of protecting citizens from potential hearing damage and various other adverse physiological, psychological, and social effects associated with noise. The federal government preempts the state on control of noise emissions from aircraft, helicopters, railroads, and interstate highways.

The California Division of Aeronautics has set noise standards governing airports that operate under a valid permit issued by the Division. These regulations control the noise in communities in the vicinity of airports. For persons residing in the vicinity of an airport, state noise standards establish a CNEL of 65 dB as an acceptable level of noise to a reasonable person.

CNEL and L_{dn} values can be useful in comparing noise environments and indicating the potential degree of adverse noise impact. However, averaging the noise event levels over a 24-hour period tends to obscure the periodically high noise levels of individual events and their possible adverse effects. These metrics have limitations in their usefulness, and the use of other noise metrics may be necessary to assess noise impact. In recognition of this limitation of the L_{dn} and

CNEL metrics, the EPA uses single-event noise impact analyses for sources with a high noise level and short duration.

The maximum sound level (L_{max}) is a noise descriptor that can be used for high-noise sources of short duration, such as space vehicle launches. The L_{max} is the greatest sound level that occurs during a noise event.

Noise exposure levels generated by and propagated from a noise source are often shown on maps by contour lines of equal noise level around the source. These lines are referred to as noise contours.

2.2.5.2 Existing Ambient Noise Levels

To evaluate existing ambient noise levels in the areas surrounding VAFB, data from noise elements of the Cities of Santa Maria (Santa Maria, 1987) and Lompoc (Lompoc, 1986), and measured data from ten different sites at VAFB were used. Noise monitoring conducted at VAFB and surrounding areas during 1984 and 1985 shows average measured noise levels (L_{eq}) of 48 dBA to 67 dBA. There were some high noise levels measured during this monitoring. These high levels were not included in calculating average noise levels because they were not representative of the average background noise levels.

According to noise measurements and noise contours of Lompoc Valley, the noise levels in rural portions of Lompoc Valley, VAFB, and Santa Maria are less than 45 dBA. Areas closer than 1 mile to the major transportation corridors will have higher noise levels. Occasionally, storm activity can increase the ambient noise level to as high as 70 dBA.

The largest urban community near the Titan IV project site is Lompoc. Automobiles, trains, trucks, and aircraft are the most significant sources of community noise in Lompoc.

The controlled airfield on North VAFB serves only military traffic. The 65 CNEL contour represents a minor impact to Lompoc, because it covers either federally or state-owned land, or floodway/floodplain-restricted and agricultural preserve land. The number of flights and types of operations are not expected to change in the near future

(Lompoc, 1986). Current space vehicle launches at VAFB are noise sources in the project vicinity that have been addressed in previous studies. Their operation noise will generate high levels but, due to their short duration and infrequent occurrence, do not influence CNEL contours for the Lompoc Valley or Santa Maria.

2.2.5.3 Construction Noise Impacts

Construction activities will temporarily increase ambient noise levels adjacent to the project site. Noise levels from most of construction equipment will not be noticeable at sensitive receptors in the Lompoc Valley or Santa Maria due to their distances from the project site. Some construction activities such as pile driving will generate a noise level of 115 dBA at 50 feet. If pile drivers are used, impulse noise levels of about 42 to 45 dBA could be expected on the west side of Lompoc, which is about 8 miles from the project site. Noise levels will be dissipated by the 400- to 500-foot-high mountains located between the Titan IV project site and Lompoc. Construction noise could be noticeable in some areas of the city with very low ambient noise levels, but these levels will not be objectionable or cause annoyance.

2.2.5.4 Operation Noise Impacts

The major operational noise source is space vehicle launch noise. Other noise sources in the launch area, such as pumps and compressors, are minor compared to rocket launch noise. Fabrication, painting, and other related operational activities are conducted inside buildings. These activities are typical for an industrial facility and similar activities occur at different locations on VAFB. All necessary noise control mitigation measures will be accomplished at appropriate facilities to meet worker noise exposure limits as specified by the Occupational Safety and Health Administration (OSHA). There will be no noise impact at sensitive receptor locations as a result of the normal operation of the proposed project facilities.

The source of space vehicle launch noise is from interaction of the exhaust jet with the atmosphere in the combustion chamber and post-burning of fuel rich combustion products in the atmosphere. The acoustic power from a space vehicle and the spectral frequency shape of

the noise are related to the size of the rocket engine, its thrust level and the specific impulse which relates to the selected propellants. Chemical rocket propulsion systems generate acoustic energy fields that encompass a wide frequency spectrum (1 Hz to 100,000 Hz). Normally a large portion of the total acoustic energy is contained in the low frequency components of the spectrum (10 Hz to 200 Hz).

To evaluate noise impacts of a space vehicle launch, it is necessary to consider, not only the overall sound level, but also the frequency spectrum and the duration of exposure. High noise levels can cause annoyance and hearing damage. OSHA has established noise limits to protect workers at their work places. According to these standards, a time-weighted noise exposure of 90 dBA is allowable for an 8-hour work day. In addition, no worker shall be exposed to noise levels higher than 115 dBA. The maximum exposure level of 115 dBA is limited to occurrences of 15 minutes in duration or less. The OSHA standards can be used to evaluate maximum allowable noise levels of the workers in the vicinity of the launch pad. OSHA standards were not developed for use in evaluating community noise exposures, but might be considered in evaluating a high level, short duration, single-event noise (e.g., space vehicle launch noise). A 24-hour average noise level (L_{eq}) of 70 dBA is recommended by the EPA for the general public as a noise exposure level that will not cause hearing damage with an adequate margin of safety. This criteria is applicable to routine, day-to-day noise whereby people are exposed over a period of time such as months or years. Noise levels higher than 55 dBA in a residential area can cause annoyance and communication interference. With regard to EPA criteria, it should be noted that single-event space vehicle launch noise is characterized by relatively short duration and limited in the number of events occurring in a 24 hour period (never more than 1). The duration of the rocket launch noise between the time periods when the noise level is within 10 dB of the maximum launch noise level will be less than 2 minutes.

The Titan IV space launch vehicle has not yet been launched from VAFB and actual noise measurements are not available. However, measured noise levels of Titan IIID launches at SLC-4E on VAFB can be adjusted, based on the thrust levels of each vehicle. Titan IIID has a thrust

level of 2,220,400 lbs at zero altitude. The Titan IV thrust level is approximately 2.5 million lbs at zero altitude. Therefore, the maximum Titan IV noise levels should be approximately 1 dB higher than the maximum noise levels generated by a Titan IIID launch. The projected maximum noise levels for Titan IV at the launch pad and vicinity are shown in Figure 2.2.5-2. Shielding effects of nearby mountains would have only a minor initial effect. Noise reduction due to atmospheric absorption has been accounted for and is reflected in these contours.

The contours indicate that noise levels in the City of Lompoc and vicinity would be between 100 dBA to 104 dBA. These levels are about 40 dBA to 60 dBA higher than ambient noise levels depending on the location and time of day. These noise levels will be for a very short period and would occur a maximum of four times a year. During a launch, the maximum noise levels in Lompoc, according to OSHA criteria and EPA criteria, would not cause hearing damage. To some, discomfort would be experienced for a short period. By comparison, Lompoc's projected maximum noise exposure during a launch might be compared with a rock music concert, although the launch noise duration would only be for seconds instead of hours, as with a concert.

Noise levels from a Titan IV launch should be about 91 dBA to 94 dBA in the vicinity of Santa Maria. These levels are about 20 dB to 45 dB higher than ambient noise levels but will not cause any hearing damage to residents of Santa Maria due to their short duration. From an annoyance standpoint, there will likely be some people in the area who find this noise level objectionable. Because of their very short duration, noise levels from the Titan IV launch will not affect existing CNEL noise contours in Lompoc or Santa Maria.

For all communities 10 to 15 miles from the launch pad, neither man nor structures would be harmed by launch noise. Vehicles that produce similar noise levels have been launched from VAFB for a number of years and are a part of environmental conditions. At worst, the launch noise might be perceived as an infrequent nuisance rather than a health hazard.

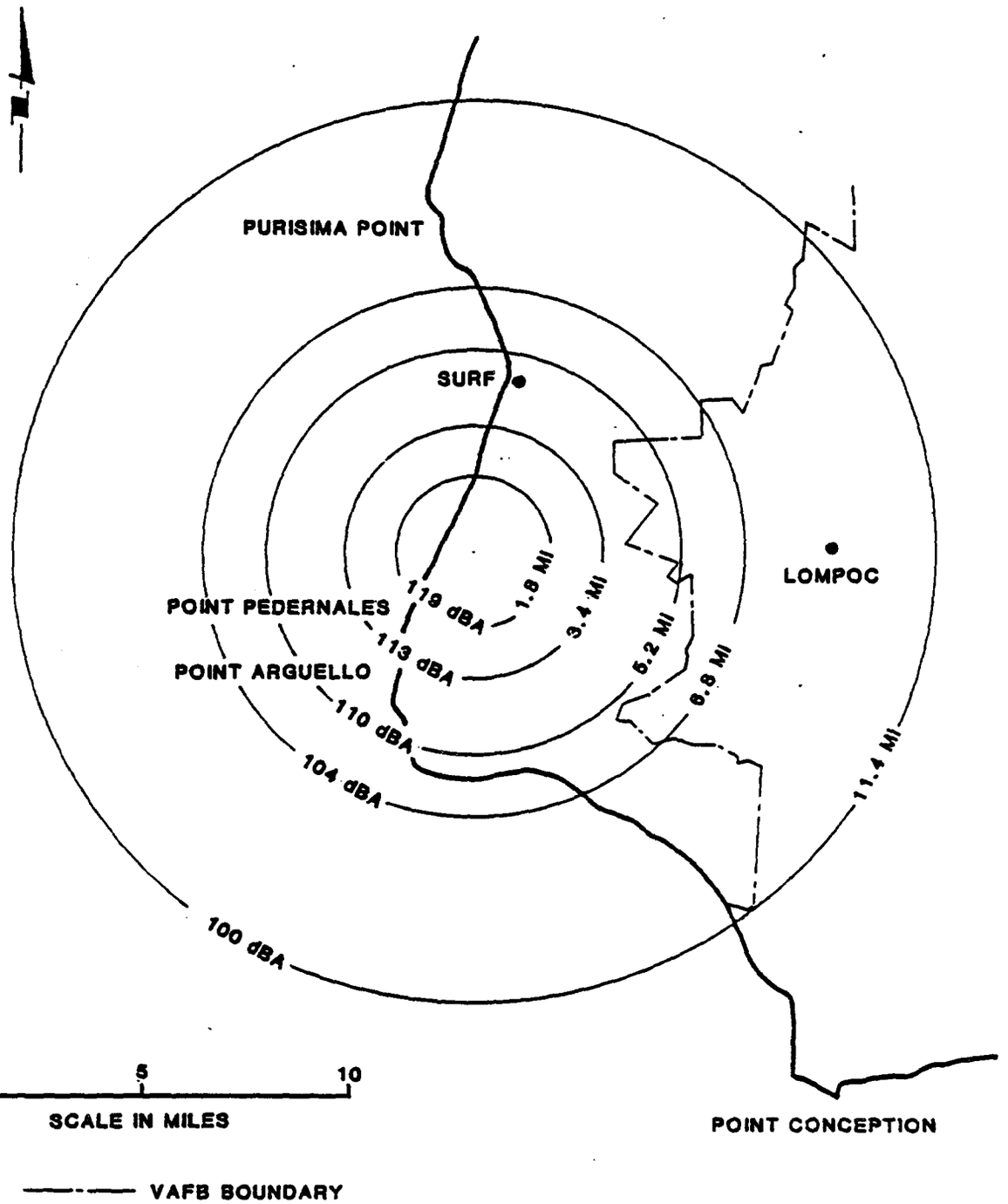


FIGURE 2.2.5-2

APPROXIMATE TITAN IV MAXIMUM NOISE LEVEL CONTOURS FROM SLC-4

VANDENBERG AIR FORCE BASE

SOURCE: ES, 1987

Noise levels around the launch pad can reach a level of about 170 dB. This sound level can cause hearing damage. Workers around the launch pad must be protected from launch noise by wearing protective devices while inside buildings that are acoustically designed to reduce noise levels below 115 dBA. Acoustic overpressures at distances between 100 and 200 feet from the launch vehicle would be approximately 0.3 to 1.3 pounds per square inch, which is equivalent to 172 to 160 decibels.

Measurements were taken to evaluate the potential for acoustically induced structural damage to La Purisima Mission (Burnett, 1975). This mission is located approximately 3 miles northeast of the city of Lompoc or approximately 11 miles east-northeast of SLC-4E and is listed in the National Register of Historic Places. The measurements taken during launch of a Titan IIID indicate that the acoustic energy is not enough to cause any structural damage. Launch of a Titan IV also should not cause any structural damage to the mission because the Titan IV generates acoustical energy that is almost the same as the Titan IIID.

A historic Colonial-revival style administration/barracks building, part of a former Coast Guard Rescue station, is located in the Point Arguello area on South VAFB approximately 6 miles southeast of SLC-4E. This station has been determined eligible for the National Register of Historic Places. During launch of a Titan IV vehicle, this structure would experience noise levels of approximately 108 dBA. This would result in vibration of the structure but this noise level would not have a magnitude that would damage normal construction. However, deteriorated building construction may experience some minor damage such as detachment and breakage of poorly secured fixtures and decoration.

A preliminary study has been conducted to calculate overpressure and sound level generated from the explosion of a Titan IV on the launch pad. The Titan IV has 149,001 pounds of Aerozine-50 as fuel, 309,824 pounds of N_2O_4 as oxidizer, and 1,183,384 pounds of solid rocket propellant. Based on its chemical composition, the solid rocket propellant was found to have an explosive equivalency of 1.34 pounds per pound of conventional explosive (i.e., TNT)(Yates, 1987). This 134 percent equivalency is the potential energy of release if sufficient stimulus is provided. Because there is insufficient overpressure (i.e.,

energy) provided by the liquid propellant, the solid rocket motors cannot mass detonate in the static or pre-launch (i.e., pre-lift off) condition (Aerospace, 1968). The liquid and solid propellants for the Titan program, therefore, have a lower TNT equivalency than indicated in the Air Force explosive safety regulations, AFR 127-100 (dated 20 May 1983, revised 1985) and have been granted an exemption to AFR 127-100. This lower explosive equivalency is based on extensive studies of the tankage configuration which reduces interfaces and the potential propellant mixing capacity (Riley, 1988). Every 100 pounds of the combined aerozine-50/N_2O_4 propellant is equal to approximately 1 pound of TNT. Thus, the liquid propellant has a TNT explosive equivalency of 1 percent. The TNT equivalency of solid rocket propellant is 0 percent in the static or pre-launch condition (ASESB, 1968). Therefore, the pre-launch Titan IV vehicle would have an explosive equivalency of about 4,588 pounds of TNT due to the liquid propellants. Overpressures at different distances were calculated for an explosion on the launch pad. Calculations were based on the curve provided in AFR 127-100.

If a Titan IV space vehicle exploded on the launch pad in a static or pre-launch condition, it would result in a blast wave of about 28 lb/sq. in. at about 100 feet from the explosion. At 800 feet the overpressure would be about 0.9 lb/sq. in. At 2,200 feet the overpressure would drop to about 0.24 lb/sq. in. The noise equivalent at 100, 800, and 2,200 feet would be 200 dB, 170 dB, and 158 dB, respectively. The nearest uncontrolled area is about 20,000 feet from SLC-4E. At this distance, an explosion on the launch pad would result in a blast wave of about 0.01 lb/sq. in. with a noise equivalent of 131 dB. These calculations are theoretical maximums that do not take into account overpressure attenuation through atmospheric absorption or the shielding effect of local topography. Considering the effects of atmospheric attenuation (estimated 7 dB) and topography (estimated 20 dB), calculated noise levels for Lompoc will not exceed 91 dB. While the noise level may be annoying to residents of Lompoc, no structural or glass window pane damage would be expected to occur in Lompoc.

In-flight destruction of the Titan IV space vehicle from the activation of one or both command destruct systems would involve the controlled burn-off of propellants. Destruction of the Titan IV space vehicle in flight as the result of a commanded destruct or a catastrophic failure could have a theoretical maximum TNT equivalence of 1.6 million pounds. However, the specific explosive equivalence would be reduced by factors such as lack of confinement of the propellant and the prior consumption of available propellant. The specific TNT equivalence of this explosion would be dependent on the physical geometry of the vehicle (i.e., altitude and configuration) and meteorological conditions at the time of explosion (Riley, 1988).

If the Titan IV space vehicle were to explode after lift off at an altitude of approximately 900 feet, it would not have burned any liquid propellant and only a small amount of solid propellant. To calculate the theoretical maximum overpressure, the total amount of propellants was used. The overpressure generated by this explosion would be essentially the same as an explosion at the launch pad. A maximum noise level of approximately 135 dB would be expected in Lompoc from this explosion. Mountains will not provide any shielding effect for an explosion at this or higher elevations but there would be some reduction of noise levels due to atmospheric absorption. At this overpressure there would be no damage to structures or glass window panes. This maximum noise level may be annoying to residents of Lompoc but would not be expected to last for more than one second.

2.2.6 CULTURAL RESOURCES

The proposed project lies within an area that was occupied by the Chumash people during the late prehistoric and historic periods. The Chumash were not actually a cultural or linguistic group, but rather a diverse population sharing a number of cultural traits and speaking several languages and dialects all common to the Hokan language family (Blackburn, 1975; Brusa, 1975). The area occupied by the Chumash people consisted of a stretch of about 150 miles of California coastline (and adjacent inland valleys) reaching from Estero Bay in the north to Topanga Canyon in the south, and including the northern Channel Islands

(Anacapa, Santa Rosa, Santa Cruz, and San Miguel Islands) (King, 1976; Baldwin, n.d.; Blackburn, 1975).

Because of the maritime orientation of the Chumash economy, larger villages were situated primarily along the coast. However, settlements were known as far as 60 miles inland. Typical villages consisted of 100 to 200 individuals and were linked by loose federations organized around principal villages (Blackburn, 1975). Villages identified in the vicinity of the proposed project from the protohistoric period are Nocto, a village of 60 to 100 people that was located 2 miles east of Point Arguello, and Lompoc, a village of 100 to 150 people located about 3 miles inland, east of the modern town of Surf and on the south bank of the Santa Ynez River (King, 1976; Versar, 1987).

The material culture of the Chumash differed little from adjacent groups, except for items associated with their maritime adaptation (Blackburn, 1975). Common items in the material culture of the Chumash were shell beads, stone tools, and basketry (Hudson and Blackburn, 1984). One of the most important aspect of their material culture was the tomol or plank canoe. The tomol enabled transportation and trade to be conducted between the mainland and island Chumash, as well as further destinations such as Santa Catalina Island and Santa Barbara Island (Baldwin, n.d.; Blackburn, 1975; Hoover, 1971). Trade between the islands and the mainland was well established, with the islands exporting manufactured goods (such as shell beads) and the mainland exporting food resources and lithic and other materials absent on the islands (King, 1976). Archaeological as well as ethnohistoric evidence indicates that most of the shell beads used as money in the entire southern California area originated from the Chumash of the northern Channel Islands (King, 1976).

2.2.6.1 Archaeological Resources

There are more than 600 archaeological sites recorded within the boundaries of VAFB, and over 2,000 archaeological sites recorded in Santa Barbara County. Because only a relatively small portion of Santa Barbara County has been surveyed for such resources, there are undoubtedly numerous other unrecorded sites in the county.

The cantonment area, airstrip and adjoining areas of North VAFB are highly disturbed. There are no recorded archaeological resources within the vicinity of Bldgs 8337, 8401, 5500, or 9325. Impacts to archaeological resources in this area were previously evaluated in the Titan II Environmental Assessment.

Extensive archaeological surveys and testing have recently been conducted for other programs on South VAFB. At SLC-4, a gaseous nitrogen pipeline has been constructed as part of the restoration effort described earlier in Section 1. Survey results for the nitrogen pipeline were submitted by the Air Force to the State Historic Preservation Officer (SHPO) who has concurred with the "no effect" determination.

Activities associated with the proposed project in the South VAFB area will occur at SLC-4E. Numerous archaeological sites have been recorded in the vicinity of SLC-4E. These sites include CA-SBa-531, -533, -534, -536, -537, -549, -678, -679, -680, -681, -684, -773, -921, -1128, -1166, -1816 and -1940.

Impacts

Construction activities associated with the proposed project will include installation of new fences around facilities to be modified on North VAFB. This work will occur along existing fence corridors and in highly disturbed areas. As long as this construction is confined to areas where construction or disturbance has previously occurred, there will be no impact to archaeological resources.

Modifications to the SLC-4 area and at Bldg 945 on South VAFB will require new construction and some major ground-disturbing activity will take place. In November 1987, Greenwood and Associates, archaeological/ historic resource consultants, conducted a field survey of some of the areas to be modified for the Titan IV program. This survey report is included in Appendix C of this document.

The areas on South VAFB that were surveyed included (1) Fallback Area 17 and associated roadwork north of SLC-4, (2) the area to be modified at Bldg 945, (3) modifications to SLC-4E including areas of new construction and the proposed borrow site, and (4) the burial of

electrical power lines in the SLC-4 area. The Greenwood survey and previous archaeological surveys by Harmsworth Associates (USAF, 1987b, 1987c, 1987d) indicate that these modifications would not result in impacts to known archaeological resources. Archaeological monitoring during earthwork for the proposed haul road will be conducted because of its proximity to site CA-SBA-1940.

2.2.6.2 Historic Resources

Much of the history of the region is associated with the establishment of missions and their affiliations with the Chumash in the late 18th and 19th centuries. Mission La Purisima Concepcion was the focus of a comprehensive restoration project in the 1930s and is listed on the National Register of Historic Places.

The National Park Service (NPS) recently conducted an inventory of historic sites on VAFB (NPS, 1987). While military use of the area, dating back to the early 1940s, is reflected in certain structures on the base, none of the Titan launch complexes at SLC-4 were nominated as historic landmarks. SLC-10, a Thor missile launch complex built in 1958, represents the early years of historic efforts to put a man in space and has been declared a National Historic Landmark. Structure 395c, a Titan missile silo built in 1961, has been maintained as a base historic site (USAF, 1987a).

A historic administration/barracks building is located 3 miles southwest of Point Arguello. This structure is part of the former U.S. Coast Guard Rescue Station that was deactivated in 1952. The administration building was built in 1936 and bears the Colonial-revival architectural style of the 1920s. The former Coast Guard Station has been determined eligible for the National Register of Historic Places. In consultation with the State Historic Preservation Officer (SHPO), the nearby boathouse and pier structure were dismantled and relocated in 1982 and 1983 to make way for construction of a transport facility for the Space Shuttle Project. The administration building has since been restored and rehabilitated in consultation with SHPO. The building is currently unoccupied.

Impacts

There would be no impact from construction and modification activities on any known historic resources in the area as a result of the proposed project. Unknown historic resources that may exist in the area could be impacted as a result of the proposed project.

It is not anticipated that any known historic site in the area will be impacted by the operation of the proposed project. However, unintentional impacts could occur from the effects of noise and vibration, washout or rainout of chemicals on historical material and associated soils, and catastrophic accidents. These impacts are believed to be insignificant for the same reasons that they were found to be insignificant for archaeological resources. Historic resources in the area can withstand the impacts of normal operation of the proposed project, and the probability of a catastrophic accident impacting historical resources is remote.

2.3 CUMULATIVE IMPACTS

The Titan IV Space Launch Vehicle Program is one of many programs being considered for development in the Santa Barbara County region and one of a number of ongoing programs on VAFB that may contribute to cumulative environmental impacts in the area. To meet National Environmental Policy Act (NEPA) requirements, adverse impacts that may be contributed by the proposed Titan IV program must be considered in combination with those of other current and proposed projects in the area. Other likely projects on VAFB and in the region include: military-related programs and modifications; offshore and onshore oil and gas development and construction and operation of processing and transportation facilities; urban and industrial development, road construction, and harbor improvements.

The proposed Titan IV Space Launch Vehicle Program is a replacement of the Titan 34D program, which is being phased out. Because of the nature of the program, it is expected that the natural environment will not experience any impact of greater intensity than those resulting from the previous Titan programs. These impacts include temporary increases

in air emissions and the noise level during a launch. Therefore, there will be no net increase in adverse impacts to the environment as a result of the proposed project and, therefore, no cumulative impact. Potential impacts are discussed below by issue area.

2.3.1 Meteorology and Air Quality

The Titan IV program will result in a temporary increase in air emissions during construction and a continuation of existing emissions from processing and launch operations. No significant increase in launch emissions over the amount generated from previous Titan 34D program is expected. Air emissions will be mitigated by the use of air pollution control equipment and by compliance with stipulations in SBAPCD permits. With respect to other anticipated projects in the area, it is expected that the proposed program will not result in any effect on the availability of air emission offsets that might be required of other projects.

2.3.2 Geology and Soils

Potential impacts to geologic resources will be prevented or mitigated to an insignificant level. Thus, the proposed program will have no cumulative impact on geologic resources. Soil erosion control procedures, such as revegetation or diversion, slowing, or retention of flow, will be initiated in new construction areas, as appropriate. The procedures applied will be consistent with the Base Land Management Plan.

2.3.3 Hydrology and Water Quality

Although the proposed project will obtain its water supply from an aquifer that is currently experiencing an overdraft, the proportion of water that will be extracted is relatively insignificant and represents a continuation of ongoing water consumption. There will be no short-term impact to groundwater hydrology of the Lompoc Terrace aquifer as a result of the Titan IV program, although long-term impacts to groundwater could result from depletion of groundwater storage from continued use by VAFB. The projected long-term impact of water use for the Titan IV program relative to current VAFB use will not be significant, and therefore, will have no cumulative impact on hydrology.

Any impact to surface water hydrology will be intermittent and, therefore, insignificant. Potential impacts to groundwater and surface water quality will be prevented or reduced by the adherence to waste discharge requirements specified by the RWQCB. Such requirements will include testing of deluge water prior to discharge. A maximum of four launches per year of the Titan IV space launch vehicle is planned and impacts will not be any greater than those of the previous Titan 34D program. Therefore, no cumulative effect on hydrology and water quality will occur.

2.3.4 Biota

The proposed project will not have any significant impact on the local or regional biota. To comply with Section (7c) of the Endangered Species Act, the Air Force will prepare a Biological Assessment to address any impact to endangered or threatened plant and animal species from the proposed Titan II and Titan IV programs. Because the proposed program is a continuation of existing launch activities and because a maximum of two launches per year is planned, no net increase in significant impacts is expected. Thus, the proposed project will not have a cumulative impact on biotic resources.

2.3.5 Population

The proposed project will not result in any increase in population on VAFB or in the surrounding area and, therefore, will not have a cumulative impact on the population of the VAFB region.

2.3.6 Socioeconomics

The proposed project will not result in a change to any land use designation or an increase in the need for additional community services and facilities. An increase in traffic may occur during construction, but this increase will be temporary and insignificant. No long-term increase in traffic will occur. No change in the economy is expected. Therefore, the proposed project will have no cumulative impact on socioeconomics.

2.3.7 Hazardous Waste

An increase in the amount of hazardous waste that will be generated at VAFB as a result of the Titan IV program will be mitigated by management practices, as stipulated by applicable federal, state, and base regulations. The Titan IV program is being evaluated under the Air Force hazardous waste minimization program and efforts will be made to reduce the generation of hazardous waste. Therefore, hazardous waste from the proposed project will not have a cumulative impact on the environment.

2.3.8 Safety

The Titan IV program will not result in an increased risk to the public. Potential impacts to public safety will be mitigated by the safety and disaster planning and preparedness aspects of the program. Therefore, the proposed project will not have a cumulative impact on public safety.

2.3.9 Noise

The Titan IV program will result in an increased noise level during a launch, but this effect will be temporary and infrequent in nature. The magnitude of this effect will only be slightly greater than for the previous Titan 34D program. Therefore, the proposed program will not have a cumulative noise impact on the environment.

2.3.10 Cultural Resources

The proposed project will not impact any known archaeological resources. Archaeological monitoring will be conducted during earthwork at the proposed haul road because of its proximity to archaeological site CA-SBA-1940. This monitoring will minimize the potential for impact to archaeological resources. In the unlikely event that any unknown archaeological resources are discovered during construction, the Air Force will consult with the State Historic Preservation Officer and the National Park Service as required by Section 106 of the National Historic Perservation Act and Air Force Regulation 126-7. Therefore, the proposed project will not result in a cumulative impact on cultural resources.

SECTION 3

REGULATORY REVIEW

3.1 AIR QUALITY

Titan IV operations at VAFB are subject to federal, state and local rules and regulations pertaining to the control of air pollutants emitted to the atmosphere. Region 9 of the U.S. Environmental Protection Agency in San Francisco, California has federal jurisdiction over the area. The California Air Resources Board is responsible at the state level for mobile sources. At the local level, the Santa Barbara County Air Pollution Control District (SBCAPCD) has authority over stationary sources of air pollutants in the area.

The Titan IV Space Launch Vehicle is exempt from Rule 202 of the SBCAPCD Rules and Regulations, which applies to vehicles used to transport passengers or freight. Based on this exemption, the launch vehicle is not required to comply with the requirements of a "Permit to Operate." This exemption, however, does not include operational support facilities and their corresponding control equipment.

Existing equipment that are permitted and will be part of the Titan IV operation include the oxidizer vapor burner, Aerozine-50 fuel vents, and N_2H_4 loading units. New equipment will include two paint spray booths and a fuel vapor incinerator system. Applications for "Permits to Operate" for this new equipment have been submitted to the SBCAPCD.

Coating operations conducted in the paint spray booths are exempt from regulation under SBCAPCD Rule 330c (categorical exemption for aerospace vehicles). All thinners and solvents used in the preparation of fairings are non-photochemically reactive; therefore, Rule 322, which prohibits the use of photochemically reactive organics in thinners and reducers, would not be applicable. As for toluene, a photochemically

reactive compound, Rule 324 limits the evaporation of photochemically reactive solvents to 1.5 gallons per day. A fairing uses 3.5 gallons of toluene over a period of six 8-hour shifts or 1.2 gallons per day (assuming 2 shifts per day). Therefore, the operation involving toluene will comply with Rule 324.

The oxidizer vapor burner system is an existing system that will be used for the Titan IV program. It has been granted a Permit to Operate by the SBCAPCD and will operate under this permit for the Titan IV Program.

The fuel vapor incinerator system, which replaces the need for a vent stack, is projected to emit 1.7 lb/hour of NO. This amount does not exceed the Best Available Control Technology (BACT) emission criteria of 5 lb/hour (SBCAPCD Rule 102). Given that the incinerator will operate for a maximum of only 22.5 hours per launch, the hourly rate averaged over a year will be insignificant. Authority to Construct and Permit to Operate permit applications for this unit have been submitted to the SBCAPCD.

VAFB is located in an area that is designated by the SBCAPCD as nonattainment for ozone, or not meeting the state ambient air quality standard for ozone. Ozone is a secondary pollutant generated by the photochemical reaction involving NO_x and reactive organic compounds (ROC). New source review (NSR) rules are promulgated to work towards the goal of achieving attainment of the ambient standards. Emissions of NO_x and ROC, which are precursors to the formation of ozone, are regulated under NSR rules. These rules require Best Available Control Technology (BACT, which is triggered at emission levels of 2.5 lbs/hr), an Air Quality Impact Analysis (AQIA, which is required at emission levels of 5 lbs/hr but not more than 10 lbs/hr, 240 lbs/day, or 25 tons/year), and emission offsets (which would be required at an emissions increase of less than 10 lbs/hr, 240 lbs/day, or 25 tons/year).

Emissions of NO_x from the fuel vapor incinerator (1.7 lbs/hr) and ROCs from the paint spray booths would be subject to new source review. The SBCAPCD defines ROCs very broadly and is quoted here as "any

volatile compound containing carbon, except: methane, carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, ammonium carbonates, and halogenated hydrocarbons." In determining ROC emissions from the PLF for permitting purposes, the SBCAPCD has provided VAFB with ROC weight percentages for the various coatings. Consumption rates for these coatings are multiplied by the corresponding ROC weight percentages and factored by the operating schedule to determine hourly emissions. Table 3.1-1 presents these calculations. Since the application of these coatings is sequential, the maximum ROC emission rate is 1.05 lbs/hr. As separate sources, the emissions from the incinerator and the paint booths are below the NSR BACT trigger levels.

TABLE 3.1-1

REACTIVE ORGANIC COMPOUND EMISSIONS
FROM PLF PROCESSING

Material Applied	ROC Weight Percent	ROC Emission Rate lb/hr
Ablative Coating	50	1.05
Silicone Seal	49.06	0.16
Silver Coating	58	0.10
Primer	45.15	0.23

Source: Martin Marietta Corp., 1988

A Titan IV launch would be expected to increase the local ambient PM_{10} concentration due to Al_2O_3 emissions from SRM combustion. The 24-hour average concentration may increase during launch day to reflect concentrations at which Al_2O_3 is released during launch. However, because of the limited number of launches per year (maximum of 4) and the short duration of a launch, Titan IV launches should not result in any discernible increase in the PM_{10} annual geometric mean. With favorable meteorological conditions during launch, the impact to local ambient PM_{10} concentrations should be minimal.

3.2 WATER QUALITY

3.2.1 INDUSTRIAL WASTEWATER DISCHARGE

Wastewater discharges resulting from the Titan IV program operations will include deluge, fire suppression, launch complex washdown water in addition to discharges from the new MST Air Conditioning Building. Deluge waters will be generated at a maximum rate of 170,000 gallons and an average rate of approximately 120,000 gallons per launch (MMC, 1986d; Pergler, 1988b). Approximately 50,000 gallons of deluge water does not evaporate and will be collected in the exhaust duct sump (EDS). Additional water may be used for fire suppression and launch pad washdown.

After a launch, samples of the EDS water will be collected and analyzed. The tests to be performed include the EPA test 601 (volatile halocarbons), 602 (volatile aromatics), the ICP metals, and general mineral analysis. Whenever possible, an analysis will be performed on a sample of water from the water system before launch to provide background data. Four samples will be taken from the sump for analysis (one from each corner). Sampling methods and protocol will be performed under federal and/or state regulations. The discharge of deluge and washdown water from SLC-4E will require a permit from the Regional Water Quality Control Board (RWQCB). The Air Force submitted Reports of Waste Discharge (ROWD) for SLC-3 and SLC-4; however, the RWQCB considered the wastewater quality poor enough to require some mitigation prior to discharge. The permitting process is ongoing while the Air Force develops additional data on the hydrogeological conditions and possible beneficial uses of water in the area. When action on the permit is resumed, the RWQCB will consider potential beneficial use of water in the area, potential for contamination, treatment of the waste in the soil, and dilution within the aquifer to set effluent discharge limits that will prevent degradation of water resources. In the meantime, the Air Force will consider drinking water standards as action levels for the wastewater. Discharge of wastewater exceeding drinking water standards will require coordination with the RWQCB before discharging. New ROWD will be required if there is a change in quantity and quality of the wastewater to be discharged.

The discharge of the deluge and washdown water will flow downgrade into the surface flow in Spring Canyon creek. The Air Force is not required to obtain an NPDES permit for this discharge because surface flow in Spring Canyon creek is blocked and ponded at the Coast Road embankment.

3.2.2 STORMWATER DRAINAGE

Stormwater is a significant portion of the wastewater discharged between launches. There is currently no requirement to test or permit the discharge of stormwater. The RWQCB has requested further information on stormwater runoff quality to determine if residues from the launch pad has contaminated stormwater to the extent that a permit would be necessary prior to discharge. As part of the Titan IV program, a valve will be installed between the flame bucket and EDS in order to preclude contamination of stormwater with chemicals in the EDS. The stormwater in the flame bucket would be tested before being released through the retention basin and into Spring Canyon. No coordination with the RWQCB will be required before discharge.

3.2.3 SANITARY WASTEWATER DISCHARGE

Sanitary waste produced at SLC-4E is treated in an onsite package sewage treatment plant in Bldg 743. This plant has a maximum capacity of 15,000 gallons per day and is currently operating from 9,000 to 11,500 gallons per day. Waste from this plant goes to evaporation/ percolation ponds located northwest of SLC-4E. The RWQCB regulates all domestic wastewater treatment facilities that discharge their effluent to the surface. Bldg 743 is regulated under the RWQCB's Order 83-60 (update of Order 79-65). This order regulates all sewage discharges in outlying areas of VAFB that do not discharge into the sewer. The SLC-4 treatment plant has periodically failed to conform with the standards for 5-day BOD and suspended solids. In order to comply with regulatory requirements and adequately dispose of sewage waste from SLC-4E, a replacement STP will be constructed by 1990.

Sanitary waste produced at the RIS module offices are discharged into a septic tank-leach field system. This discharge is regulated by RWQCB Order 83-12 which establishes an agreement between the RWQCB and

the Air Force for the regulation of sewage discharge into such a system. If sanitary sewage is the only type of waste to be discharged, no permit is required from the RWQCB. However, if industrial waste is to be discharged, a permit may be required unless it is considered a minimal amount.

3.3 HAZARDOUS WASTE

Hazardous waste produced as a result of the Titan IV program is currently permitted under a State Hazardous Waste Facility Permit. VAFB was issued this permit in November 1986. Hazardous waste that is expected to be generated by the Titan IV program at VAFB is listed in Appendix B.

All hazardous waste produced at SLC-4 will be located at the launch complex for a time period no longer than 60 days. Three additional days will be allowed to arrange for transport of waste from SLC-4. Hazardous waste will be forwarded to Collection Accumulation Points (one on North VAFB and one on South VAFB) and transferred to the permitted Base Hazardous Waste Storage Facility.

3.4 SPILL PREVENTION

EPA's Oil Pollution Prevention Regulation requires facilities to prepare and implement a plan to prevent any discharge of oil (petroleum products) into waters of the United States. This plan is referred to as the Spill Prevention Control and Countermeasure (SPCC) Plan. VAFB operates under a SPCC plan which is currently being reviewed and will require a facility evaluation by a registered engineer.

3.5 COASTAL MANAGEMENT PROGRAM

A Coastal Consistency Determination is being submitted by the Air Force in compliance with the Federal Coastal Zone Management Act of 1972, as amended (16 USC Section 1456(c)), Section 307(c)(1), and with Section 930.34 *et seq.* of the National Oceanic and Atmospheric Administration (NOAA) Federal Consistency Regulations (15 CFR 930, revised). These regulations require federal agencies to ensure that

their undertakings are consistent to the "maximum extent practicable" with the NOAA-approved state Coastal Management Program (CMP) for actions that may have a direct impact on a state's coastal zone.

In California, the California Coastal Commission, as lead agency for the CMP, coordinates the evaluation of a determination and develops a formal state consistency response. As stated in 15 CFR 930, federal activities on federal property are excluded from state-designated coastal zones. If the activity has an impact off federal property that could result in a direct impact to the state coastal zone, these activities must be consistent.

The Titan IV program does not involve new construction or activities in the California Coastal Zone outside of federal property and no impact will result from the Titan IV program outside of federal property and within the state coastal zone.

3.6 THREATENED AND ENDANGERED SPECIES

The Federal Endangered Species Act of 1973 (as amended) extends legal protection to plants and animals listed as endangered or threatened by the U.S. Fish and Wildlife Service (USFWS). Section 7(c) of the Endangered Species Act authorizes USFWS to review proposed federal actions to assess potential impacts on such listed species.

The Air Force is cognizant of the importance of protecting endangered and threatened species and their critical habitats. The Air Force began an early consultation process with the USFWS Endangered Species Office in Laguna Niguel, California, and the National Marine Fisheries Services (NMFS) on Terminal Island, California, to identify potential species and areas of concern. Copies of the USAF notification letters, along with the USFWS and NMFS responses are provided in Appendix A.

In accordance with Section 7(c) of the Act, the Air Force is preparing a combined Biological Assessment for those endangered and threatened species known or expected to occur in the vicinity of SLC-4E and SLC-4W and other Titan II and Titan IV program-related facilities. This Biological Assessment will address the modifications to the

existing structures, construction of new facilities and subsequent launch operations as they may affect threatened and endangered species. The Biological Assessment will provide greater detail on the potential effects of the program and will be submitted to the USFWS in support of a "No Jeopardy Opinion."

In addition to species listed by the USFWS, the California Department of Fish and Game (DFG) protects species listed as threatened, endangered, or rare. Discussions of candidate species that are proposed for listing will also be included in the Biological Assessment.

Marine mammals protected by the Marine Mammals Protection Act (PL 92-522), which is administered by the NMFS, will be discussed in the Biological Assessment. Consultation with the NMFS (see Appendix A) resulted in the recognition of two species, the gray whale and the Guadalupe fur seal, for which this agency is responsible.

3.7 NATIONAL HISTORIC PRESERVATION ACT

The National Historic Preservation Act of 1966 (P.L. 89-665; 80 Stat. 915; 16 U.S.C. 470) sets forth a national policy of historic preservation. The act defines the term historic preservation as "the protection, rehabilitation, restoration, and reconstruction of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, or culture." It establishes the National Register of Historic Places and includes resources of state and local, as well as national significance; establishes the President's Advisory Council on Historic Preservation; provides for states to conduct statewide surveys and prepare State Historic Preservation Plans; authorizes grants by the Secretary of the Interior to the states to support surveys, planning, and preservation activities, and prescribes certain procedures (Section 106) to be followed by federal agencies in the event that a proposed project might affect significant properties. 36 CFR 60 defines the appropriate terms and sets forth in detail the procedures for nominating sites to the National Register of Historic Places.

Section 106 as amended and implemented by the "Procedures for the Protection and Enhancement of Historic and Cultural Properties" (36 CFR 800) requires that where sites listed on or eligible for inclusion on the National Register will be affected by federally funded, assisted, or licensed projects, the responsible agency shall consult with the State Historic Preservation Office (SHPO) and, where necessary, the Keeper of the National Register (actually the Act states Secretary of Interior) to determine the significance of the property, then consult with the SHPO and the Advisory Council to develop methods of mitigating the effect. Compliance procedures are provided for federal agencies under Section 106 of the National Historic Preservation Act and Executive Order 11593 by 36 CFR 800.

36 CFR 800 sets forth procedures for reviewing projects to determine whether they affect in any way properties on or eligible for the National Register. Additional review procedures are established for those instances where an adverse effect can be established. This regulation also sets forth the power of the Advisory Council to comment upon all such instances and the criteria for "effect" and "adverse effect." Both regulations list criteria for determining whether a property is eligible for the National Register.

Executive Order 11593 of May 13, 1971 (Protection and Enhancement of the Cultural Environment) (36 CFR 8921, 16 U.S.C. 470) directs all federal agencies to conduct an inventory of historic properties under their ownership or control, nominate eligible properties to the National Register of Historic Places, and give priority in inventory to federally owned properties to be transferred or altered. It also directs federal agencies to develop policies that will contribute to the preservation of non-federally owned historic properties, to exercise caution until inventories and nominations to the National Register are complete, and to ensure that eligible properties are not inadvertently damaged or destroyed.

The Titan IV program will have no effect on any known archaeological or historic site because construction is limited to areas: (1) found not to contain resources, or (2) previously subjected to extensive

disturbance from past construction activities. In addition, archaeological monitoring will be conducted during earthwork for the proposed haul road because of its proximity to a known site. This will minimize the potential for impacts to archaeological resources. Therefore, in accordance with the requirements of the National Historic Preservation Act, 36 CFR 800, Section 106, a "No Effect Determination" is appropriate. Results of recent surveys and literature review in support of a "No Effect Determination" for the proposed Titan IV Program are documented in Appendix C. The Air Force will submit a "No Effect Determination" with this Environmental Assessment to the SHPO for concurrence.

SECTION 4

MITIGATION MEASURES

4.1 AIR QUALITY

Mitigation measures to minimize impacts to air quality from Titan IV launches are incorporated into the program as process control and operational control. Process control involves the use of air pollution control equipment while operational control is discretionary and based on actual and predicted conditions. The air pollution control devices include a fuel vapor incinerator system (FVIS), an oxidizer vapor burner, and air filters for the spray booths. Operational control involves making a decision whether or not to launch based on predicted meteorological conditions and is a means to minimize impacts on onshore air quality to which humans, and plant and animal life, can be exposed (see Section 2.1.1.3).

The fuel vapor incinerator controls fuel vapor through combustion in a propane-fired incinerator. Fuel vapor is generated during bulk fuel transfer, fuel system checkout (RSV, Stage I, and Stage II vessel pressurizations), and post-launch fuel system purgings. Fuel vapor will be collected and incinerated in the FVIS. The FVIS will control fuel vapor for a maximum of 22.5 hours per launch.

Oxidizer vapor, generated in the same manner as fuel vapor, is controlled with an existing oxidizer vapor burner. This burner is rated at 10 lb/hour of nitrogen tetroxide and has been certified and permitted by the Santa Barbara County Air Pollution Control District.

The payload propellant loading vapors will be vented to the N_2O_4 burner or to the vapor incinerator, as appropriate.

The paint spray booths will be equipped with filters to prevent overspray from becoming airborne. The filters will be changed as necessary to ensure that paint particles are not emitted to the atmosphere.

The Toxic Hazard Corridor (THC) forecast described earlier is another mitigation measure that will minimize impacts to air quality. Because of the wind patterns (onshore) and inversion in the Vandenberg area, it is important to base a decision to launch on such a forecast. The uncontrolled areas are only 4 miles away from the launch area and exposure of humans and other forms of life to unhealthful air quality is possible under adverse events and conditions.

The control measures described above will mitigate any adverse impacts to air quality.

4.2 GEOLOGY AND SOILS

4.2.1 STRATIGRAPHY

No mitigation measure is required.

4.2.2 PALEONTOLOGIC RESOURCES

If fossil remains are uncovered during ground-disturbing activities, impacts to the fossil site will be avoided until a qualified paleontologist has removed them and allowed construction to proceed. This measure will ensure that scientifically important remains and geologic data are not lost to construction impacts.

4.2.3 SOILS

A mitigation plan involving revegetation and erosion control to comply with the Base Land Management Plan will be implemented as part of construction of Titan IV facilities. Areas disturbed by construction will be revegetated by native or naturalized species. The revegetation effort will include soil preparation, seeding, mulching, fertilizing, irrigation, and inspection. All areas left barren by construction, including cut and fill slopes, will receive erosion control treatment.

In addition, the underlying topsoil (to a depth of 1 ft) of any construction-scarred areas will be stockpiled and replaced as soon as possible after construction.

Construction and operation of project facilities will be monitored to reduce the potential for and magnitude of spills and wildfires. VAFB has established a Spill Prevention Control and Countermeasure Plan in accordance with Title 40, Code of Federal Regulations, Part 112 to provide services and facilities for mitigating impacts from oil spills. Crews will be available during construction and operation of the facilities to clean up and dispose of spilled and contaminated material in an environmentally approved manner and to extinguish wildfires.

4.2.4 GEOLOGIC HAZARDS

The project facilities have been designed to resist seismically induced groundshaking. To reduce the risk of accidents or injuries, the area will be monitored for seismic activity to ensure that construction and operational activities are suspended during seismic events.

No mitigation measure is necessary for liquefaction and soil creep/landslides.

4.3 HYDROLOGY AND WATER QUALITY

4.3.1 GROUNDWATER

Potential contamination of groundwater resulting from the discharge of deluge and washdown water will be minimized through the adherence to waste discharge requirements to be set forth by the California Regional Water Quality Control, Central Coast Region (RWQCB). All deluge and washdown water will be collected in the EDS and analyzed before discharge. Analysis of EDS water will safeguard water quality from contamination. If the water in the EDS is found to be contaminated, it will be treated and disposed of in accordance with federal and state regulations. VAFB will also adhere to the RWQCB's determination regarding stormwater runoff and its potential for contamination of Spring Canyon. No discharge of contaminated water will result from launch activities at SLC-4E.

Any potential impact to groundwater due to disposal of sewage wastewater would be mitigated through proper use of the onsite sewage treatment plant, however the existing plant has intermittently been in non-conformance with the standards for 5-day BOD and suspended solids. A replacement STP will be constructed by 1990, possibly sooner, to adequately dispose of sewage waste at SLC-4.

4.3.2 SURFACE WATER

Potential impacts due to accidental spills of propellant will be mitigated through the use of spill containment structures surrounding the fuel handling area, oxidizer handling area, and the ready storage vessel area. Any potential contaminant collected will be disposed of in accordance with federal and/or state regulations.

Impacts to water quality resulting from HCl and Al_2O_3 deposition for the Titan IV ground cloud will be mitigated by the buffering capacity of Spring Canyon. Launches will be infrequent. Potential contamination of surface water in Spring Canyon resulting from the discharge of deluge and washdown water will be prevented or minimized through adherence to waste discharge requirements as described above.

4.4 BIOTA

The Titan IV program will not have any significant impact on the local or regional biota. Approximately one acre of natural habitat outside the SLC-4 fence will be destroyed during construction and modification activities. Any areas used for temporary construction laydown and prefabrication will be restored after use. Any construction-scarred areas will be revegetated with native or naturalized species, as discussed in Section 4.2.3. SLC-4E does not adjoin any unique vegetative community or critical wildlife habitat. The specific impacts, if any, of the Titan IV program on threatened and endangered species will be addressed in a Biological Assessment being prepared by the Air Force as part of its Section 7 consultation process with the USFWS.

4.5 POPULATION

4.5.1 DEMOGRAPHY AND HOUSING

No mitigation measure is necessary.

4.6 SOCIOECONOMICS

4.6.1 LAND USE COMPATIBILITY

No mitigation measure is necessary.

4.6.2 COMMUNITY FACILITIES AND SERVICES

No mitigation measure is necessary.

4.6.3 TRANSPORTATION

No mitigation measure is necessary.

4.6.4 ECONOMY

No mitigation measure is necessary.

4.7 SAFETY

No mitigation measure is necessary.

4.8 HAZARDOUS WASTE

The Air Force has a hazardous waste minimization program which is based on product substitution, recycling and on-site treatment where feasible. The Titan IV program is being evaluated under this program. Efforts will be made to reduce the generation of hazardous waste from the Titan IV program.

All hazardous waste produced by the Titan IV program will be managed in accordance with applicable federal and state regulations. No mitigation measure is necessary.

4.9 NOISE

Mitigation measures to protect health and welfare will not be required for Titan IV launch noise affecting the Lompoc or Santa Maria communities. The noise levels from the launch are not high enough to

cause hearing damage or other health hazards. In addition, a maximum of two launches per year is planned; therefore, there should be no major impact or extended annoyance from the launch operations.

Mitigation measures will be required to protect workers at the launch facility and in surrounding areas from very high noise levels. All workers at the launch area should wear protective hearing devices and/or be inside acoustically protected buildings. Buildings that will be occupied during the launch should have acoustically treated doors, windows, and ventilation systems to meet inside noise level requirements of not more than 115 dBA. A worker outdoors using hearing protectors alone (e.g., earplugs and earmuffs worn together) could expect only 15 to 45 dB attenuation in the significant frequency range. This would not be adequate protection in noise impacted areas above approximately 145 dBA (closer than approximately 600 feet to the launch vehicle). Therefore, enclosed structures for workers would be required at the immediate launch area. Road blocks and other methods should be used to prohibit entry to the launch facility and surrounding areas that have high noise levels during launch.

4.10 CULTURAL RESOURCES

4.10.1 ARCHAEOLOGICAL RESOURCES

The proposed project will not impact any known archaeological site because all construction will be limited to areas of previous disturbance. In the unlikely event that unknown archaeological resources are discovered during construction, construction activities will be monitored by a qualified archaeologist. If archaeological resources are discovered, all activities in the vicinity of the remains shall cease or be redirected until an archaeologist has evaluated the find and allowed work to proceed in the affected area. In addition, the Air Force will consult with the State Historic Preservation Officer and the National Park Service prior to the resumption of construction activities in the affected area.

The existing road from SLC-4E to Dix Road, which will be improved for use as a haul road, is in close proximity to a known archaeological

site, SBA-CA-1940. For this reason, archaeological monitoring will be conducted during earthwork (i.e. grading) at this location. This mitigation will reduce the potential for impacts to archaeological resources.

4.10.2 HISTORIC RESOURCES

Because the impact of the proposed project on historic resources is not anticipated to be significant, no mitigation measure is necessary. This may be modified pending the results of the field survey by Greenwood Associates.

4.11 VISUAL RESOURCES

No mitigation measure is necessary.

SECTION 5

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The following individuals were contacted during preparation of this Environmental Assessment.

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Bill Shipsey	City of Santa Maria

SECTION 6

REFERENCES

Aerospace Corporation, 1968, Evaluation of Explosive Hazard Criteria and Safety Practices Associated with Titan III Launch Facility Siting, Design and Operations, Report No. TOR-0158 (3302)-1, January.

American Conference of Governmental Industrial Hygienists Threshold Limit Values and Biological Exposure Indices for 1985-1986, 1985.

Air Force Regulation (AFR) 127-100, 1985, Explosives Safety Standards.

Armed Services Explosives Safety Board (ASESB), 1968, Technical Information Bulletin No. 16, Washington, D.C., April.

Arthur D. Little, Inc., 1985, Union Oil Project/Exxon Project Shamrock and Central Santa Maria Basin Area Study EIS/EIR, Technical Appendix A, Geology, prepared for County of Santa Barbara, U. S. Minerals Management Service, California State Lands Commission, California Coastal Commission, and California Office of Offshore Development, SCH No. 84062703, SBC No. 84-EIR-17, OCS Study MMS No. 85-0020, SLC-EIR No.379, 18 March.

Aviation Week & Space Technology (AW&ST), 1986, Explosion Sequence Photos Depict Titan 34D Launch Failure, 3 November.

Baldwin, Mary Alice, n.d., Archaeological Evidence of Cultural Continuity from Chumash to Salinan Indians in California, San Luis Obispo County Archaeological Society, Occasional Paper No. 6, San Luis Obispo County Archaeological Society, San Luis Obispo, CA.

Bidstrup, F., 1987, Personal Communication with David E. Moss, ES, April.

Blackburn, Thomas, C., 1975, December's Child: A Book of Chumash Oral Narratives, University of California Press, Berkeley, CA.

Brusa, Betty War, 1975, Salinan Indians of California and Their Neighbors, Naturegraph Publishers, Healdsburg, CA.

Burnett, Ronald D., 1975, Noise Monitoring Titan IIID Launch, prepared for USAF Environmental Health Laboratory, McClellan Air Force Base, California, January.

California Air Resources Board, 1987, California Air Quality Data: Summary of 1986 Air Quality Data, Gaseous and Particulate Pollutants, Sacramento, California, July.

California Department of Transporation (CALTRANS), 1985, Traffic Volumes on the California State Highway System.

Chambers Group, Inc., 1986, Draft EIR/EIS, Proposed Arco Coal Oil Point Project, Volume I and Appendix 6-Terrestrial Biology, SCH No. 84011105, SLC No. EIR-401, SBC No. 86-EIR-12, U. S. Army COE Permit Appl. No. 85-047-RC, September.

Collins, Paul, 1987, Associate Curator, Invertebrate Zoology, Santa Barbara Natural History Museum, Personal Communication with David E. Moss, ES, April.

Dibblee, T. W. Jr., 1950, Geology of Southwestern Santa Barbara County, California, Point Arguello, Lompoc, Point Conception, Los Olivos, and Gaviota Quadrangles, California Division of Mines Bulletin 150, 95 p.

Earth Sciences Associates (ESA), 1982, Supplemental Water Study for Vandenberg Air Force Base, California, prepared with PCR Toups, prepared for USAF/SAC, March.

Engineering-Science, Inc. (ES), 1985, Biological Assessment, Threatened and Endangered Species, Proposed Pacific Texas Pipeline Project, June.

EPA (U.S. Environmental Protection Agency), 1972, Compilation of Air Pollutant Emission Factors, 4th Edition, Research Triangle Park, North Carolina, September.

ES, 1986a, Minutes of Titan II/Titan IV EA Kick-off Meeting, 30 October 1986, prepared by ES submitted to SD/DEV, 31 October.

ES, 1986b, Minutes of Technical Interchange Meeting for Titan II/Titan IV Air Quality Issues, 12 November 1986, prepared by ES submitted to SD/DEV, 14 November.

ES, 1986c, Minutes of Technical Interchange Meeting for Titan II/Titan IV Water Quality Issues, 13 November 1986, prepared by ES submitted to SD/DEV, 18 November.

ES, 1986d, Minutes of Technical Interchange Meeting for Titan II/Titan IV Air and Water Quality Issues, 1 December 1986, prepared by ES submitted to SD/DEV, 10 December.

ES, 1987, Final Environmental Assessment, Titan II Space Launch Vehicle Modifications and Launch Operations Program, Vandenberg Air Force Base, California, prepared for Department of the Air Force, Headquarters Space Division, August.

ERT, 1984, Biological Assessment, Threatened and Endangered Species, Proposed Celeron/All American and Getty Pipeline Projects, August.

Foerster, K., 1987, Wildlife Biologist, USFWS, Personal Communication with David E. Moss, ES, May.

Gawthrop, W. H., 1978, "Seismicity and Tectonics of the Central California Coastal Region," In Silver, E.A., and Normark, W. R., editors, "San Gregorio-Hosgri Fault Zone, California," California Division of Mines and Geology Special Report 137, p.45-56.

Hoover, Robert L., 1971, Chumash Typologies for Dating and Computer Analysis, San Luis Obispo County Archaeological Society, Occasional Paper No. 2, Cuesta College, San Luis Obispo, CA, February.

Howald, A., P. Collins, S. Cooper, W. Ferren, P. Lehman, K. Saterson, and K. Steele, 1985, Terrestrial and freshwater biology. Appendix F. In: Union Oil Project/Exxon Project Shamrock and Central Santa Maria Basin Area Study EIS/EIR. Prepared for County of Santa Barbara, U.S. Minerals Management Service, California State Lands Commission, California Coastal Commission, California Office of Offshore Development, by Arthur D. Little, Inc., Santa Barbara, California, cited in Versar, 1987.

Hudson, Travis, and Thomas C. Blackburn, 1984, The Material Culture of the Chumash Interaction Sphere, Volumes I-V, Ballena Press/Santa Barbara Museum of Natural History Cooperative Publication, Menlo Park and Santa Barbara, CA.

Jensen, D. B., 1983, The Status of California's Natural Communities: Their Representation on Managed Areas, The Nature Conservancy, unpublished report cited in Versar, 1987.

King, Chester, 1976, Chumash Inter-Village Economic Exchange, In Lowell John Bean and Thomas C. Blackburn, eds., Native Californians: A Theoretical Retrospective, Ballena Press, Ramona, CA.

Lehman, P., 1982, The Status and Distribution of the Birds of Santa Barbara County, California. Unpublished Masters thesis. Department of Geography, University of California, Santa Barbara, cited in Versar, 1987.

Lompoc, 1974, Environmental Resource Management Element, City of Lompoc General Plan, Prepared by Wilsey and Ham, Inc., September.

Lompoc, 1986, City of Lompoc Noise Baseline Summary Report, Prepared by Endo Engineering, 17 October.

Lompoc Record, 1987, River Fishery Loss "Astounds" Sport-fishing Group, 13 December.

Martin-Marietta Corporation (MMC), 1981, Shuttle Payload Integration Facility (SPIF) Program, MCR-81-016 Rev. A, June.

MMC, 1984, Final Report for Fuel Vapor Incinerator Set, A/M 32A-89, Part No. SK1379-5000-009, Contract F42600-81-D-1379, prepared by Keith Wanklyn, Attachment B (Performance Test Report, Fuel Vapor Incinerator Set, A/M32A-89, Part No. SK1379-5000-009, Serial No. 0000001, December 1984), December.

MMC, 1986a, Titan II SLV Integrated Accident Risk Assessment Report, Phase I Draft, MCR-86-6005, Contract No. F04701-85-C-0085, prepared by the Titan II SLV System Safety Staff, 16 September.

MMC, 1986b, Viewgraphs distributed at Titan II/Titan IV Environmental Assessment Kick-off Meeting, 30 October.

MMC, 1986c, Titan II SLV Implementation Plan, Vandenberg Operations, Revision 2, December.

MMC, 1986d, Titan II and Titan IV launch water use and spill containment information in response to MMC action items from meeting of 13 November 1986.

MMC, 1987a, Viewgraphs distributed at Titan II/Titan IV VAFB Environmental and Facilities Requirements Meeting, 28 January.

MMC, 1987b, Titan IV RIS 60% Facility Design Criteria Review, VAFB, prepared for Department of the Air Force, Headquarters Space Division, 29 July.

MMC, 1987c, Titan II and Titan IV Waste Stream Flows, letter from J. A. Hoien, Manager, Contracts, Vandenberg Operations, to J. V. Wolcott, SD/DEC, 16 January.

MMC, 1987d, Launch Facilities, WTR Modifications, Facility Design Criteria - Titan IV, VAFB, Revision B, 31 August.

MMC, 1987e, Titan IV/NUS Integrated Accident Risk Assessment Report, Phase I, Volumes I through IV, Preliminary, MCR-87-2515, Contract No. F04701-85-C-0019, 22 June.

Mason, Robert, 1987, Personal Communication with Rosemarie Crisologo, ES, December.

Meese, Bill, RWQCB, 1987, Personal Communication with Patrick Atchison, ES, April.

Minerals Management Service (MMS), 1985, Biological Assessment of Threatened and Endangered Species of the Central Santa Maria Basin from Proposed Oil and Gas Development and Production Offshore Point Pedernales, Santa Barbara County, California, March.

National Park Service (NPS), 1987, Man In Space Study of Alternatives, Draft Review Copy, March.

Naydol, A., 1987, VAFB Environmental Task Force, Personal Communication with David E. Moss, ES, 5 January.

Pergler, Chuck, 1986, Personal Communication with David E. Moss, ES, 8 December.

Pergler, Chuck, 1987, Personal Communication with David E. Moss, ES, April.

Pergler, Chuck, 1988a, Personal Communication with Rosemarie Crisology, ES, January.

Pergler, Chuck, 1988b, Personal Communication with Patrick Atchison, ES, 19 January.

Riesbol, Bill, 1988, Personal Communication with Elvira Gaddi, ES, 25 January.

Riley, Bill, 1988, Personal Communication with Rosemarie Crisologo, ES, 27 January.

Rodrique, R. F., G. J. Bakus, W. N. Jessee, and J. F. LaMorte, 1976, A Twelve-Month Investigation of the Intertidal Biology at Ocean Beach and the Point Arguello Boathouse, Report TC-630, USAF, Hq. Space and Missile Systems Organization, March.

Rodrigue, R. F., G. J. Bakus, and E. K. Noda, 1974, Interim Report: Coastal Environmental Survey of the Vandenberg AFB Region, California, Report No. TC-439, USAF, Hq. Space and Missile Systems Organization, September.

San Diego State University, 1976, Ecological assessment of Vandenberg AFB, California, Biological inventory 1974/75, prepared by Center for Regional Studies, San Diego State University, San Diego, California, for Headquarters Space and Missile Systems Operations, Air Force systems Command, Los Angeles, California.

Santa Barbara County-Cities Area Planning Council, 1985, Santa Barbara County 1980-2000 Population, Employment, Housing, Land Use Forecast 85, Santa Barbara County, as included in Versar, 1987.

Santa Barbara County, 1982, Coastal Plan, Resource Management Department, cited in Versar, 1987.

Santa Barbara County, 1985, Proposed Getty Gaviota Consolidated Coastal Facility of Gaviota, California FEIS/EIR, as referenced in Section 3.7.4 of USAF, 1987c.

Santa Barbara County Air Pollution Control District (SBAPCD), 1984, Rules and Regulations, September Revision.

Santa Maria, 1987, City of Santa Maria Noise Element, prepared by Michael Brandman Associates, Inc., February.

Sasaki, Shoken, 1987, California Department of Fish and Game, Team Leader, Unarmored Threespine Stickleback Endangered Species Recovery Team, personal communication with David E. Moss, ES, May.

Smith, J. R., 1975, Effects of Shuttle Noise and Exhaust Products Dispersion on Launch Site Selection at Vandenberg AFB, Report No. TOR-0075 (5421-04)-9, Aerospace Corporation, 31 March.

Stearns Catalytic, 1987, Hydrogeology Study of Space Launch Complexes 3 and 4, Vandenberg Air Force Base, CA.

Stearns-Roger, 1987, Assumptions and Requirements for Temporary Facilities and Utilities, based on MMC Proposal dated June 29, 1987 for Procurement and Construction of Titan IV Modifications to SLC-4E Launch Facilities.

United States Air Force (USAF), 1975, Final Environmental Statement, United States Air Force Space Launch Vehicles, 1 February.

USAF, 1976a, Preliminary Draft Candidate Environmental Statement, Space Transportation System, Vandenberg AFB, September.

USAF, 1976b, Safety Missile Mishap Prevention, 1st Strategic Aerospace Division Regulation 127-200, 22 October.

USAF, 1976c, Aerospace Medical Research Laboratory/BBE, Miscellaneous Noise Data, letter dated 4 February.

USAF, 1976d, Ecological Assessment of Vandenberg Air Force Base, California, Volume I: Evaluation and Recommendations 1974 / 1975, Final Report, August 1975, San Diego State University, Center for Regional Environmental Studies, (Coulombe, H. N. and C. F. Cooper, ed.) for USAF, Headquarters Space and Missile Systems Organization, AFCEC-TR-76-15, May.

USAF, 1977a, Reference Document to EIS, Space Shuttle Program, Vandenberg Air Force Base, Volumes I and II, August.

USAF, 1977b, Maximum Utilization Plan (TAB A-1) for Vandenberg Air Force Base, Lompoc, CA.

USAF, 1978, Final Environmental Impact Statement for the Space Shuttle Program, Vandenberg AFB, California, January.

USAF, 1980, Socioeconomic Baseline Study, Space Transportation System, Vandenberg AFB, CA, Draft Report, prepared by Henningson, Durham & Richardson, Santa Barbara, California, March.

USAF, 1982a, Environmental Assessment for the Proposed Deactivation of the Titan II Missile System, Proposed Final, July.

USAF, 1982b, Environmental Resource Maps for STS Station Sets, Submitted to USAF and MMC by The Ralph M. Parsons Company, 17 sheets, 19 November.

USAF, 1983a, Supplement to the Final EIS for the Space Shuttle Program, Vandenberg AFB, California, July.

USAF, 1983b, Vandenberg Air Force Base Emission Survey, USAF Occupational and Environmental Health Laboratory, Aerospace Medical Division (AFSC), Brooks Air Force Base, Texas, January.

USAF, 1984, Analysis of STS Ascent Sonic Boom and Risk of Window Damage, May.

USAF, 1985, Environmental Assessment for Construction and Operation of Space Shuttle Power Plant and Natural Gas Pipeline, Vandenberg AFB, January.

USAF, 1986a, Environmental Assessment for the Complementary Expendable Launch Vehicle at Cape Canaveral AFS, Florida, June.

USAF, 1986b, Letter from Lt. Col. Laimon T. Tarzier, Program Liaison Division, Office of Legislative Liaison, to Honorable George J. Mitchell, United States Senate, Washington, D.C., regarding Titan Explosion at VAFB on 18 April 1986, 14 August.

USAF, 1986c, Water Quality Data for SLC-4 obtained from VAFB Base Hospital.

USAF, 1986d, Biological Assessment for the Guadalupe Fur Seal, March 4.

USAF, 1986e, Improved AFSC Hazardous Waste Handling Procedure at VAFB, Memorandum from DEC to WSMC/PME, 28 August.

USAF, 1986f, Environmental Assessment for Testing of Titan Solid Propellant Rocket Motors, Edwards Air Force Base, California, December.

USAF, 1987a, Draft Environmental Impact Statement for the Mineral Resource Management Plan, Potential Exploration, Development, and Production of Oil and Gas Resources, Vandenberg Air Force Base, California, June.

USAF, 1987b, A Treatment Program for Historic Properties Affected by the Space Launch Complex 4 Restoration Program, Vandenberg Air Force Base, Santa Barbara County, California, prepared by Harmsworth Associates, 29 April.

USAF, 1987c, Documentation in Support of U.S. Air Force No Adverse Effect Determination, Security Fence Construction Project, Space Launch Complex 4 Reactivation, Vandenberg Air Force Base, California, 11 June.

USAF, 1987d, Documentation in Support of U.S. Air Force No Adverse Effect Determination and Evaluations of National Register Eligibility Status for Affected Historic Properties, Natural Gas Pipeline Project Space Transportation System Program, Vandenberg Air Force Base, Santa Barbara County, California, 6 November.

U.S. Department of Commerce (USDC), 1983, 1980 Census of Population and Housing, Census Tracts, Santa Barbara-Santa Maria-Lompoc, California, PHC80-2-324, Issued July.

USDC, 1985, 1980 Census of Population and Housing, Congressional Districts of the 99th Congress, Part 6, California, PHC80-4-6, Issued February.

U.S. Soil Conservation Service, 1972, Soil Survey of Northern Santa Barbara Area, California.

Versar, 1987, Environmental Assessment for the Repair and Restoration of Space Launch Complex 4 at Vandenberg Air Force Base, California, 5 May.

Woodring, W. P., and Bramlette, M. N., 1950 Geology and Paleontology of the Santa Maria District, California, U. S. Geological Survey Professional Paper 222, 185p.

XonTech, Inc., 1986, Operation of the Vandenberg Ambient Air Quality Monitoring Program, Monthly Report (January to December), prepared for County of Santa Barbara Air Pollution Control District, Van Nuys, California.

Yates, D.N., 1987, Comparison of Titan IV Solid Propellant to TNT, letter report to E.W. Tuttle, Engineering-Science, 17 December.

SECTION 7

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SECTION 8

ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
ACS	Attitude Control System
AFB	Air Force Base
AFR	Air Force Regulation
AFSC	Air Force Systems Command
afy	acre-feet per year
$AlCl_3$	Aluminum chloride
Al_2O_3	Aluminum oxide
ASESB	Armed Services Explosives Safety Board
ave.	average
BACT	Best Available Control Technology
Bldg	Building
C^-	Carbon ion
CAP	Collection Accumulation Point
CA-SBa	State of California, Santa Barbara County Archaeological Site
CCC	California Coastal Commission
CELV	Complementary Expandable Launch Vehicle
CFR	Code of Federal Regulations
cfs	cubic feet per second
CH^-	Hydrocarbon ion
CMP	Coastal Management Program
CNDDB	California National Diversity Data Base
CNEL	Community Noise Equivalent Level
CO	carbon monoxide
CO_2	carbon dioxide
dB	decibel
dBA	decibel (A-weighted)

DFG	California Department of Fish and Game
DLA	Defense Logistics Agency
DMSP	Defense Meteorological Satellite Program
DOD	Department of Defense
EL	Elevation
E	East
EPA	U.S. Environmental Protection Agency
ES	Engineering-Science
ft	feet
FHA	Fuel Holding Area
fps	feet per second
FVIS	Fuel Vapor Incinerator System
gal	gallon
GN_2	gaseous nitrogen
gpd	gallons per day
gpm	gallons per minute
GSA	Gas Storage Area
H	height
H_2	hydrogen molecule
H_2O	water
HC	hydrocarbon
HCl	hydrogen chloride
HDA	High Density Acid (IRFNA derivative)
HWSF	Hazardous Waste Storage Facility
Hz	Hertz
ICP	Inductively coupled plasma
ICBM	Intercontinental Ballistic Missile
ILC	Initial Launch Capability
IRFNA	inhibited red fuming nitric acid
IRP	Installation Restoration Program
IS	Island
lb	pound
lb/hr	pound(s) per hour
lb/min	pound(s) per minute
L_{dn}	average day-night sound level
L_{eq}	equivalent sound level

L_{max}	maximum sound level
LN_2	liquid nitrogen
LOX	liquid oxygen
LSB	Launch and Services Building
max.	maximum
mcf	million cubic feet
MCL	Maximum Contaminant Level
MEK	methyl ethyl ketone
mgd	million gallons per day
mg/l	milligrams per liter
mi	mile
MMC	Martin Marietta Corporation
MMES	Martin Marietta Environmental Systems
MMH	Monomethyl hydrazine
MSL	Mean Sea Level
MST	Mobile Service Tower
mph	miles per hour
MX	Peace Keeper Missile
N	North
NAAQS	National Ambient Air Quality Standards
NAFB	Norton Air Force Base
NASA	National Aeronautics and Space Administration
NDMA	form of nitrosamine
neg.	negligible
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NMI	nautical miles
NO	nitrogen oxide
No.	number
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
N_2	nitrogen molecule
N_2O_4	Nitrogen Tetroxide
N_2H_4	Hydrazine

NOAA	National Oceanic and Atmospheric Administration
NROSS	Navy Remote Ocean Sensing System
O_2	oxygen
O_3	ozone
OH	hydroxide
OHA	Oxidizer Holding Area
OSHA	Occupational Safety and Health Administration
oz	ounce
PEL	Permissible Exposure Limit
PL	Public Law
PLF	Payload Fairing
PM	Particulate matter
ppm	parts per million
PPR	Payload Preparation Room
Pt	Point
qt	quart
RIS	Receipt, Inspection and Subassembly
ROC	Reactive Organic Compounds
RP-1	kerosene-type hydrocarbon fuel
RSV	Ready Storage Vessel
RWQCB	Regional Water Quality Control Board
S	South
SAC	Strategic Air Command
SBCAPCD	Santa Barbara County Air Pollution Control District
SCB	Southern California Bight
Sec	Second
SD/DEV	U.S. Air Force Space Division, Department of Environmental Planning
SHPO	State Historic Preservation Officer
SLAMS	State and Local Air Monitoring Stations
SLC	Space Launch Complex
SLV	Space Launch Vehicle
SO_2	Sulfur Dioxide
SPCC	Spill Prevention, Control, and Countermeasure
SO_x	Sulfur oxides
SRM	Solid Rocket Motor

Stat.	Statute
STEL	Short-term exposure limit
STP	Sewage Treatment Plant
Stg	Stage
SV	Space Vehicle
T	Time
TCE	trichloroethylene
TCEE2	trans-1,2-dichloroethylene
TDS	total dissolved solids
THC	Toxic Hazard Corridor
TLV	Threshold Limit Value
TVC	Thrust Vector Control System
TWA	Time-weighted average
Thick	Thickness
TSP	Total Suspended Particulates
UDMH	Unsymmetrical dimethyl hydrazine
ug/m^3	micrograms per cubic meter
USAF	United States Air Force
USC	United States Code
USDC	U.S. Department of Commerce
USFWS	U.S. Fish and Wildlife Service
V	Velocity
VAFB	Vandenberg Air Force Base
W	West
WDR	Waste Discharge Requirements
WINDS	Weather Information Network and Display Systems
WTR	Western Test Range

APPENDIX A

CONSULTATION LETTERS AND RESPONSES FOR THREATENED AND ENDANGERED SPECIES

Appendix A presents consultation letters and responses from the USFWS and NMFS for Threatened and Endangered Species

13B-18-13

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS SPACE DIVISION (AFSC)
LOS ANGELES AIR FORCE STATION, PO BOX 92960
LOS ANGELES, CA 90009-2960

21 NOV 1986

Mr. Ray Bransfield
U.S. Department of the Interior
Fish and Wildlife Service
Endangered Species Office
24000 Avila Road
Laguna Niguel, CA 92677

Dear Mr. Bransfield

The U. S. Department of the Air Force, Headquarters Space Division is proposing to modify Space Launch Complex (SLC) 4, which consist of two launch pads (SLC-4 East and SLC-4 West) at Vandenberg Air Force Base, Santa Barbara, CA, to launch two modified Titan space launch boosters to support the Department of Defense space mission. SLC-4 East and West were originally constructed in the mid 1960s for launching of Titan space boosters. The two pads have been in continuous use since their construction. As advances are made in space launch technology, the Titan vehicle has been modified to launch heavier payloads. The proposed modifications allow for the continuation of the Titan program.

The two Titan launch vehicles proposed consist of the Titan II, a deactivated Intercontinental Ballistic Missile being converted to a space launch booster; and the Titan IV, a modified Titan 34D. Launch operations, including pre-launch and post-launch operations (loading of propellants, water deluge systems), are not being modified.

In accordance with the National Environmental Policy Act of 1969, Space Division is analyzing the environmental impacts associated with the proposed modifications to SLC-4 and the launch of the two modified Titan space boosters. Included in this analysis process is compliance with the Endangered Species Act and the Marine Mammal Protection Act. A Biological Assessment, as defined by Section 7 of the Endangered Species Act, will be prepared and will act as the basis for consultation with your office and the National Marine Fisheries.

This letter begins the informal Section 7 Consultation process. Attachment 1 is a regional map showing the location of Vandenberg AFB. Attachment 2 is a local map showing the location of SLC-4

East and West. Attachment 3 is the proposed list of federally protected endangered and threatened species potentially affected by the proposed action.

Request that your office review the attached species list to ensure that all species of concern are included. This list will be the basis for the Biological Assessment. If the list is incomplete, request that you provide an amended list of species that need to be included in the Biological Assessment.

We have also consulted with the National Marine Fisheries for those species under their jurisdiction rather than yours.

Your cooperation and support is appreciated. We look forward to working with your office on this matter. If there are any questions, or if you need additional information, please contact Mr. Robert Mason of my staff at (213) 643-0933.

Sincerely

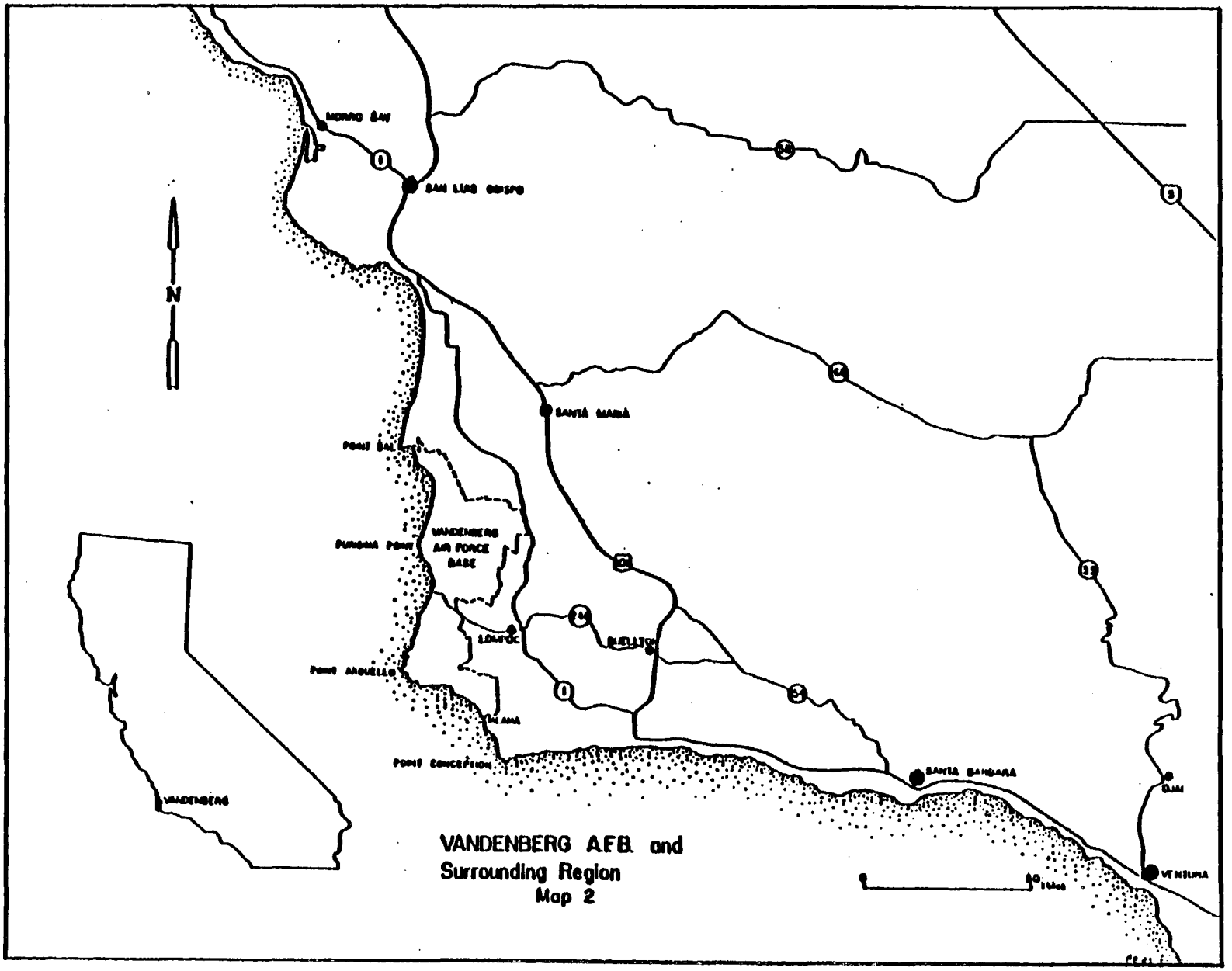
SIGNED

RAPHAEL O. ROIG
Chief, Environmental Planning Division
Directorate of Acquisition Civil Engineering

3 Atch
1. Regional Map
2. Project Map
3. Proposed Species List

cc: Mr Skip Ladd
Sea Otter Coor
U.S. Fish and Wildlife

Mr Kobetich
Sacramento, Endangered Office



VANDENBERG A.F.B. and
Surrounding Region
Map 2

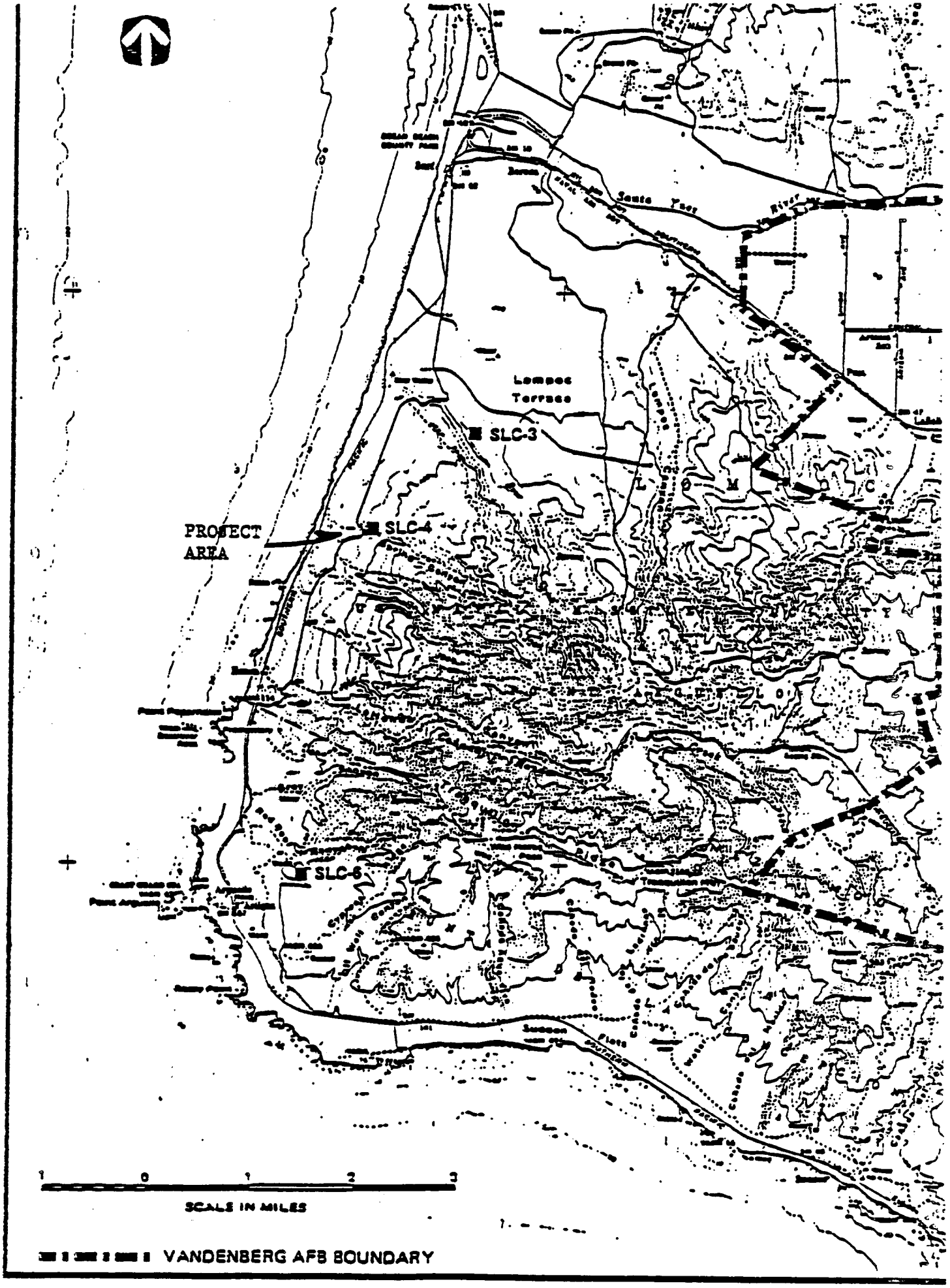


FIGURE 2 MAP OF THE SLC AND PROJECT SITE AREA

LIST OF SPECIES
TO BE ADDRESSED IN BIOLOGICAL ASSESSMENT
FOR TITAN II / TITAN IV PROJECT
VANDENBERG AIR FORCE BASE, CA

	STATUS
Birds	
Peregrine Falcon	E^f, E^s
Bald Eagle	E^f, E^s
California Least Tern	E^f, E^s
California Brown Pelican	E^f, E^s
Least Bell's Vireo	E^f, E^s
Western Snowy Plover	C
Mammals	
Gray Whale	E^f
Guadalupe Fur Seal	T^f, T^s
Southern Sea Otter	T^f
Fish	
Unarmored Threespine Stickleback	E^f, E^s
Plants	
Lompoc Yerba Santa	R^s
Salt Marsh Bird's Beak	E^f, E^s

Channel Islands Species Protected by Marine Mammal Protection Act

California Sea Lion
Harbor Seal
Stellar Sea Lion
Northern Fur Seal
Northern Elephant Seal

E^f = Federally-listed Endangered Species
T^f = Federally-listed Threatened Species
E^s = State-listed Endangered Species
T^s = State-listed Threatened Species
R^s = State-listed Rare Species
C = Federal candidate Species

FILE 13B-18-13

United States Department of the Interior

FISH AND WILDLIFE SERVICE
LAGUNA NIGUEL FIELD OFFICE
24000 Avila Road
Laguna Niguel, California 92656

December 12, 1986

Raphael O. Roig, Chief
Environmental Planning Division
Department of the Air Force
Los Angeles Air Force Station, P.O. Box 92960
Los Angeles, California 90009-2960

Re: Endangered Species Information for the Proposed Modification to Vandenberg Air Force Base's Space Launch Complex 4 (#1-6-87-SP-50)

Dear Mr. Roig:

This is in response to your letter, dated 21 November 1986 and received by us on 24 November 1986, requesting information on listed and proposed endangered and threatened species which may be present within the area of the subject project in Santa Barbara County, California.

The attached list of species fulfills the requirements of the Fish and Wildlife Service (Service) under Section 7(c) of the Endangered Species Act of 1973, as amended (Act).

The Federal agency has the responsibility to prepare a Biological Assessment if your project is a construction project which may require an Environmental Impact Statement[17]. The purpose of this procedure is to determine whether or not a listed species is likely to be affected by the proposed project. In addition to field surveys, you should consult recognized experts and review the literature. The assessment should be completed within 180 days; if not initiated within 90 days, the accuracy of the enclosed list should be informally verified with us. If a Biological Assessment is not required, your agency still has the responsibility to review its proposed activities and determine whether the listed species will be affected.

During the assessment or review process, the Federal agency may engage in planning efforts, but may not make any irreversible commitment of resources. Such a commitment could constitute a violation of Section 7(a)(2) of the Act. If a listed species may be affected, the Federal agency should request, in writing through our office, formal consultation pursuant to Section 7 of the Act. Informal consultation may be used to exchange information and resolve conflicts with respect to listed species prior to a written request for formal consultation. I have also included a list of candidate species presently under review by this service for consideration as endangered or threatened. It should be noted that candidate species have no protection under the act. Therefore, you are not required to perform a Biological Assessment for candidate species nor to consult with the Fish and Wildlife Service should you determine

your project may affect candidate species. They are included for the sole purpose of notifying Federal agencies in advance of possible proposals and listings which at some time in the future may have to be considered in planning Federal activities. If early evaluation of your project indicates that it is likely to affect a candidate species adversely, you may wish to request technical assistance from this office.

Should you have any questions regarding the species on the enclosed list, or Federal agency responsibilities under the Act, please call Ray Bransfield at FTS 796-4270 or (714) 643-4270.

Sincerely yours,

Nancy M. Kaufman

Nancy M. Kaufman
Project Leader

Enclosure

1/ "Construction Project" means any major Federal action which significantly affects the quality of the human environment designed primarily to result in the building or erection of man-made structures such as dams, buildings, roads, pipelines, channels, and the like. This includes Federal actions such as permits, grants, licenses, or other forms of Federal authorizations or approval which may result in construction.

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR IN THE AREA OF THE PROPOSED

Vandenburg Air Force Base
Space Launch Complex 4
#1-6-87-SP-50

LISTED SPECIES

Birds	
Brown pelican	Pelecanus occidentalis (E)
California least tern	Sterna albifrons browni (E)
Bald eagle	Haliaeetus leucocephalus (E)
American peregrine falcon	Falco peregrinus anatum (E)
Least Bell's vireo	Vireo bellii pusillus (E)
Mammals	
Southern sea otter	Enhydra lutris nereis (T)
Guadalupe fur seal	Arctocephalus townsendi (T)
Gray whale	Eschrichtius robustus (E)
Fish	
Unarmored threespine stickleback	Gasterosteus aculeatus williamsoni (E)

CANDIDATE SPECIES

Mammals	
Spotted bat	Euderma maculata (2)
Towsend's western big-eared bat	Plecotus townsendii townsendii (2)
Greater mastiff bat	Eumops perotis californicus (2)
Birds	
California black rail	Laterallus jamaicensis conturniculus (2)
Western snowy plover	Charadrius alexandrinus nivosus (2)
Long-billed curlew	Numenius americanus (2)
White-faced ibis	Plegades chihi (2)
Ferruginous hawk	Buteo regalis (2)
Tricolored blackbird	Agelaius tricolor (2)

(E) -Endangered (T) -Threatened (CH) -Critical Habitat
(1) -Category 1: Taxa for which the Fish and Wildlife Service has sufficient biological information to support a proposal to list as endangered or threatened.
(2) -Category 2: Taxa which existing information indicates may warrant listing, but for which substantial biological information to support a proposed rule is lacking.
(3) -Category 3(c): Taxa more common than previously thought, no longer being considered for a listing proposal at this time.

Endangered Species List (Cont'd)

Reptile	
Western pond turtle	*Clemmys marmorata* (2)
Amphibians	
California red-legged frog	*Rana aurora draytoni* (2)
Arroyo toad	*Bufo microscaphus californicus* (2)
Fish	
Tidewater goby	*Eucyclogobius newberryi* (2)
Invertebrates	
Salt marsh skipper butterfly	*Panoquina panoquinoides errans* (2)
plants	
Swamp sand wort	*Arenaria paludicola* (2)
Hoover's baccharia	*Baccharis plummerae* ssp. *glabrata* (2)
Morning glory	*Calystegia collina* ssp. *venusta* (2)
Soft-leaved Indian paintbrush	*Castilleja mollis* (2)
Lilac	*Ceanothus impressus* var. *nipomensis* (2)
La Graciosa thistle	*Cirsium loncholepis* (2)
Surf thistle	*Cirsium rhothophilum* (2)
Beach spectacle-pod	*Dithyrea maritima* (2)
Lompoc yerba santa	*Eriodictyon capitatum* (2)
Roderick's fritillary	*Fritillaria grayana* (2)
Crisp monardella	*Monardella crispa* (2)
San Luis Obispo curly-leaved monardella	*Monardella undulata* var. *frutescens* (2)
Hoffman sanicle	*Sanicula hoffmannii* (2)
Black-flowered figwort	*Scrophularia atrata* (2)

13B-18-13

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS SPACE DIVISION (AFSC)
LOS ANGELES AIR FORCE STATION, PO BOX 92960
LOS ANGELES, CA 90009-2960

23 MAR 1987

Mr. E. Charles Fullerton
Southwest Regional Director
National Marine Fisheries Service
U.S. Department of Commerce
National Oceanic and Atmospheric Administration
300 South Ferry Street
Terminal Island, CA 90731

Dear Mr. Fullerton

The U. S. Department of the Air Force, Headquarters Space Division is proposing to modify Space Launch Complex (SLC) 4, which consist of two launch pads (SLC-4 East and SLC-4 West) at Vandenberg Air Force Base, Santa Barbara, CA, to launch two modified Titan space launch boosters to support the Department of Defense space mission. SLC-4 East and West were originally constructed in the mid 1960s for launching of Titan space boosters. The two pads have been in continuous use since their construction. As advances are made in space launch technology, the Titan vehicle has been modified to launch heavier payloads. The proposed modifications allow for the continuation of the Titan program.

The two Titan launch vehicles proposed consist of the Titan II, a deactivated Intercontinental Ballistic Missile being converted to a space launch booster; and the Titan IV, a modified Titan 34D. Launch operations, including pre-launch and post-launch operations (loading of propellants, water deluge systems), are not being modified.

In accordance with the National Environmental Policy Act of 1969, Space Division is analyzing the environmental impacts associated with the proposed modifications to SLC-4 and the launch of the two modified Titan space boosters. Included in this analysis process is compliance with the Endangered Species Act and the Marine Mammal Protection Act. A Biological Assessment, as defined by Section 7 of the Endangered Species Act, will be prepared and will act as the basis for consultation with your office and the U.S. Fish and Wildlife Service.

This letter begins the informal consultation process with your agency. Attachment 1 is a regional map showing the location of Vandenberg AFB. Attachment 2 is a local map showing the

location of SLC-4 East and West. Attachment 3 is the proposed list of federally protected endangered and threatened species potentially affected by the proposed action.

Request that your office review the attached species list to ensure that all species of concern are included. This list will be the basis for the Biological Assessment. If the list is incomplete, request that you provide an amended list of species that need to be included in the Biological Assessment.

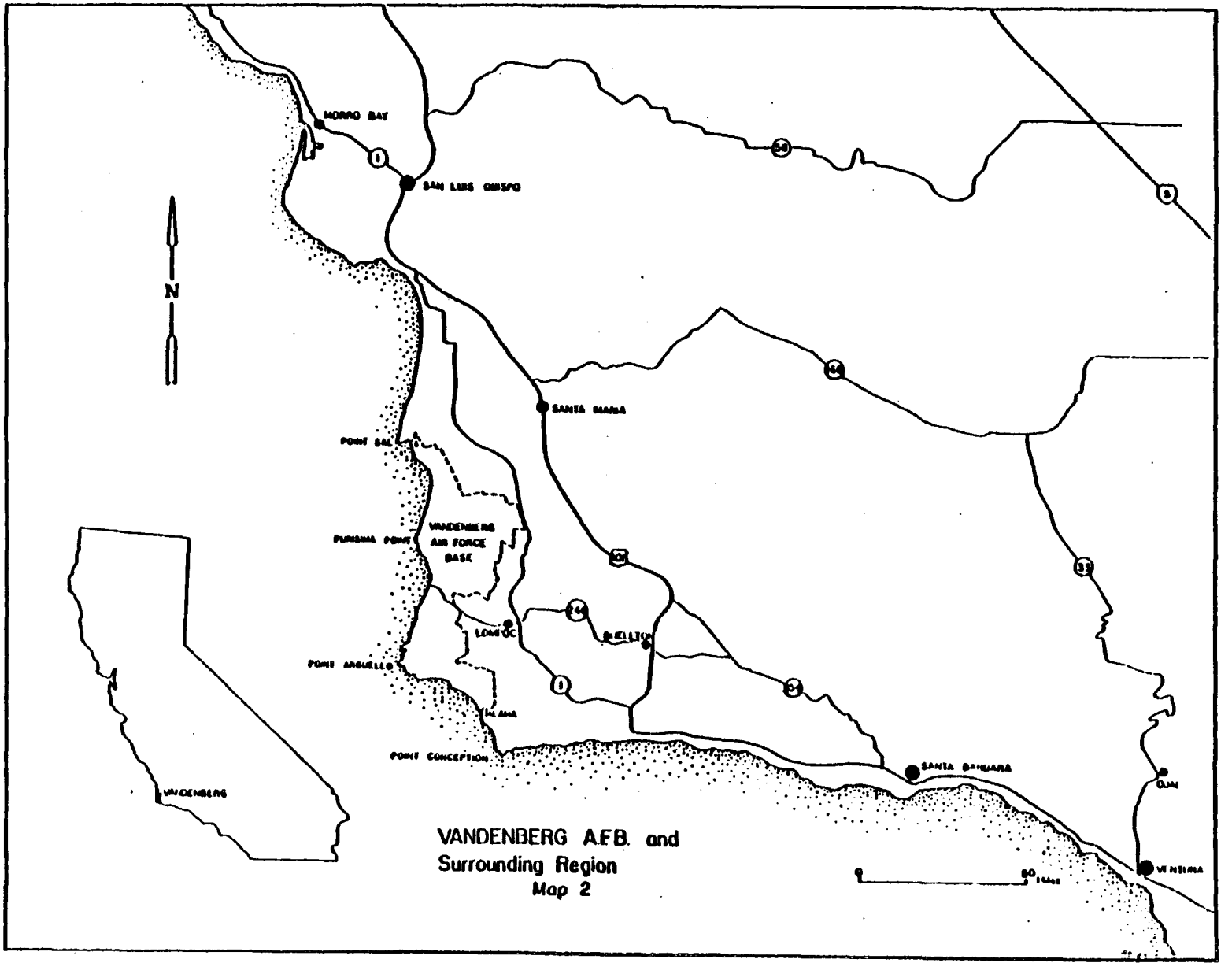
We have also consulted with the U.S. Fish and Wildlife Service for those species under their jurisdiction rather than yours.

Your cooperation and support is appreciated. We look forward to working with your office on this matter. If there are any questions, or if you need additional information, please contact Mr. Robert Mason of my staff at (213) 643-0933.

Sincerely

RAPHAEL O. ROIG
Chief, Environmental Planning Division
Directorate of Acquisition Civil Engineering

3 Atch
1. Regional Map
2. Project Map
3. Proposed Species List


MORRO BAY
SAN LUIS OBISPO
SANTA MARIA
POINT SAL
PURISIMA POINT
VANDENBERG AIR FORCE BASE
LOMPOC
POINT ARGUELLO
LA HONDA
POINT CONCEPTION
SANTA BARBARA
OJAI
VENTURA
VANDENBERG
N
VANDENBERG A.F.B. and
Surrounding Region
Map 2

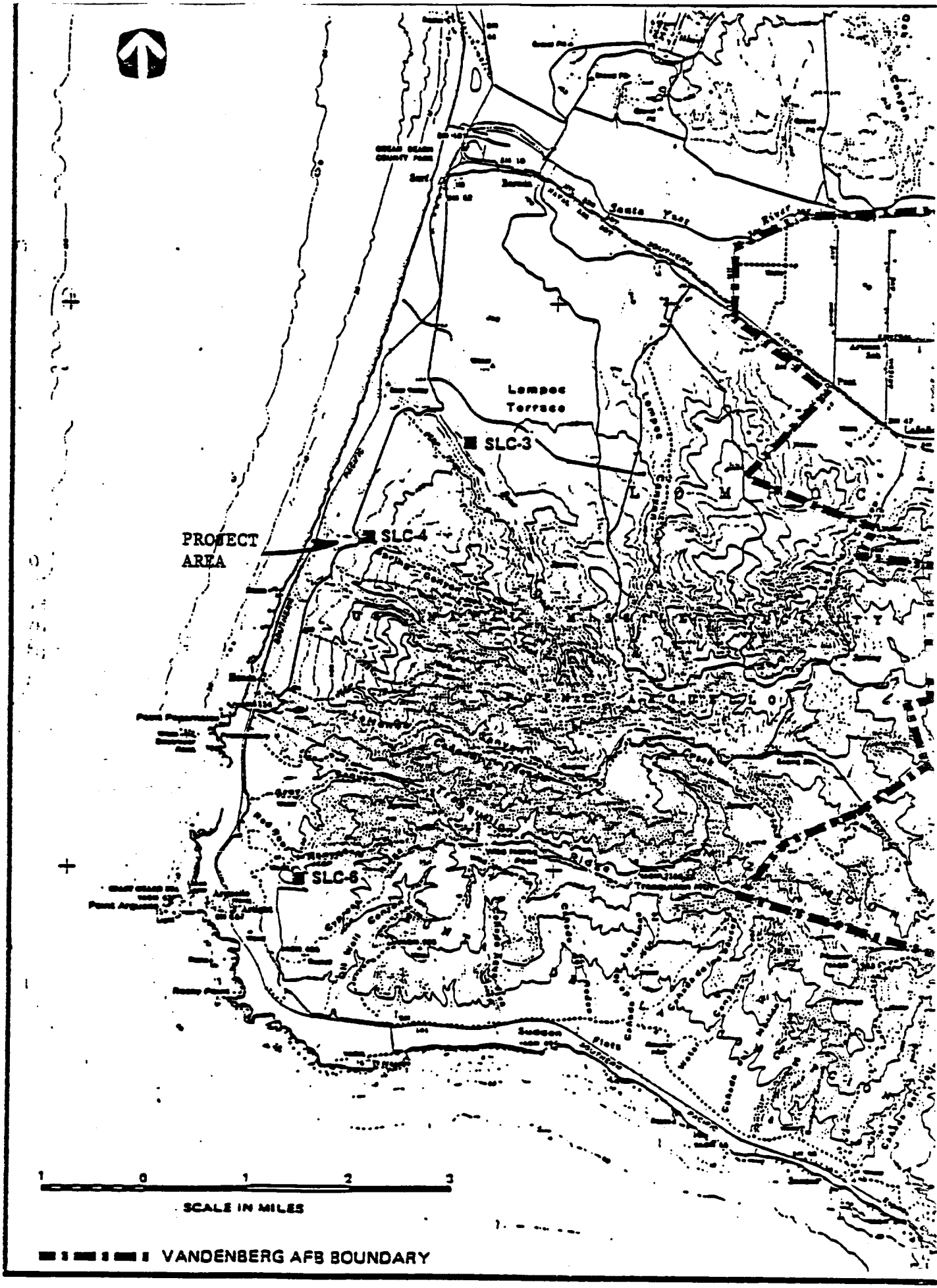


FIGURE 2 MAP OF THE SLC AND PROJECT SITE AREA

LIST OF SPECIES
TO BE ADDRESSED IN BIOLOGICAL ASSESSMENT
FOR TITAN II / TITAN IV PROJECT
VANDENBERG AIR FORCE BASE, CA

	STATUS
Birds	
Peregrine Falcon	E^f, E^s
Bald Eagle	E^f, E^s
California Least Tern	E^f, E^s
California Brown Pelican	E^f, E^s
Least Bell's Vireo	E^f, E^s
Western Snowy Plover	C
Mammals	
Gray Whale	E^f
Guadalupe Fur Seal	T^f, T^s
Southern Sea Otter	T^f
Fish	
Unarmored Threespine Stickleback	E^f, E^s
Plants	
Lompoc Yerba Santa	R^s
Salt Marsh Bird's Beak	E^f, E^s

Channel Islands Species Protected by Marine Mammal Protection Act

California Sea Lion
Harbor Seal
Stellar Sea Lion
Northern Fur Seal
Northern Elephant Seal

E^f = Federally-listed Endangered Species
T^f = Federally-listed Threatened Species
E^s = State-listed Endangered Species
T^s = State-listed Threatened Species
R^s = State-listed Rare Species
C = Federal candidate Species

FILE 1313-18-13

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
300 South Ferry Street
Terminal Island, California 90731

April 1, 1987 F/SWR33:DJS
1514-05

Raphael O. Roig
Chief Environmental Planning
Air Force Headquarters Space Division
P. O. Box 92960
Los Angeles, CA 90009-2960

Dear Mr. Roig:

This responds to your March 23, 1987 request for information concerning threatened or endangered marine species that may be found in the vicinity of a proposed project to modify the Space Launch Complex (SLC) 4 and to launch two modified Titan space boosters from Vandenberg Air Force Base, California.

Only two listed species for which the National Marine Fisheries Service is responsible are likely to occur in areas where project activities are likely to produce measurable impacts. The gray whale, Eschrichtius robustus, listed as endangered, migrates along the coast of California from December through March. The Guadalupe fur seal, Arctocephalus townsendi, listed as threatened, uses western portions of San Miguel Island to haul out from May to August and may wander north along the central California coast during other periods of the year.

If you require additional assistance, contact Mr. Dana J. Seagars of my Protected Species Staff at 213 514-6665 or FTS 795-6199.

Sincerely,

E. C. Fullerton
Regional Director

cc: N. Foster, F/M

APPENDIX B

HAZARDOUS WASTE INVENTORY

FOR THE

TITAN IV PROGRAM

AT VANDENBERG

AIR FORCE BASE, CALIFORNIA

This Appendix contains the following:

TABLE B-1

WASTE STREAM FLOW CHANGES
AT SLC-4E FOR TITAN IV PROGRAM

Product	Waste Quantity	
	Solid (lb/yr)	Liquid (gal/yr)
1.1.1 Trichloroethane	1	0
1.1.1 Trichloroethane	50	0
Adhesive	3	0
Adhesive (APR Wetting Agent 2)	5	0
Adhesive (Loctite)	1	0
Adhesive, Contact CMT (Weld)	7	0
Alcohol, Denatured	25	25
Alcohol, Isopropyl	1	0
Alcohol, Isopropyl	0	27
Alcohol, Methyl	0	188
Alcohol, Methyl	2	0
Aliphatic/IPA	1	0
Bleach	0	1,100
Bleach	1,000	0
Burndy Penetrox A	0	0
Cannister Mask Cartridge	1,200	0
CC-330	50	0
Chico A5	7	0
Cleaner (General Foam)	15	0
Cleaning Fluid	272	0
Corrosion Inhib	13	0
Corrosion Inhib	78	0
Dashpot Fluid	1	0
Dearborn 537	0	165
Degreaser	11.5	0
Desicant	1	0
Desicant	332	7
Duct Sealer	3	0
Dyes (Dyken)	1	0
Dynatherm	6	0
Electrolube	1	0
Ethylene Glycol, Antifreeze	0	55
Ethylene Glycol, Antifreeze	70	0
Filter Coat	1.5	0
Fluorosilicone Oil	1	0
Freon	30	0
Freon	14	0
Freon TF	1	0
Fuel Detox	200	200
Fuel Post rinse	200	200
Fuel Pre rinse	200	200
Grease	2	0
Grease (Molykote)	15	0
Grease, Petroleum Base	15	0

TABLE B-1 (Continued)

Product	Waste Quantity Solid (lb/yr)	Liquid (gal/yr)
Hydroxyacetic Acid	0	137
Hydroxyacetic Acid	1,250	0
Iridite	50	0
Lubricant	2	0
Lubricant	0	150
Lubricant	370	0
Lubricant (Drilube)	1	0
Lubricant (Drilube)	7	0
Lubricant (LPS)	3	0
Lubricant (Drilube TF)	9	0
Lubricant, Antiseize	4	0
Martyte	1,469	0
Methyl Ethyl Ketone	25	8
Microbiocide H-430	20	0
Nitric Acid	0	1
Oil, Auto Transmission	6	6
Oil, Brake System	4	0
Oil, Capella	0	71
Oil, Capella	20	0
Oil, Cutting	5	0
Oil, Immersion	1	1
Oil, Gage	1	0
Oil, Hydraulic	0	30
Oil, Hydraulic	30	0
Oil, Hydraulic	348	100
Oil, Low Temp	1	0
Oil, Lube	4	0
Oil, Lube	3	0
Oil, Lube	125	0
Oil, Lube	50	2
Oil, Lube (Break Free)	1	0
Oil, Lube (WD-40)	5	0
Oil, Lube, Penetr (VP-30)	1	0
Oil, Vacuum Pump	0	5
Oil, Vacuum Pump	5	0
Ospho	50	0
Oxidizer Detox	200	200
Oxidizer Post-rinse Detox	200	200
Oxidizer Post-rinse Detox	0	200
Oxidizer Pre-rinse Detox	200	200
Paint	84	0
Paint, Enamel	84	0
Paint, Primer	13	0
Paint, Primer	35	0
Paint, Stripper	100	0
Paint, Thinner	600	0
Pasajell	6	0

TABLE B-1 (Continued)

Product	Waste Quantity Solid (lb/yr)	Liquid (gal/yr)
Permatex	1	0
Rags	25	0
Rags	100	0
Rags	5	0
Rags	25	0
Rags	50	0
Rags	5	0
Rags, Iridite	25	0
Rags, Oil	25	0
Rags, Solvent	15	0
RC 380 Water Treatment	0	110
RC 380 Water Treatment	30	0
Rubber Cement	1	0
Rust Remover	1	0
Sealant	4	0
Sealant (Loctite)	2	0
Silicone (Dow Corning III)	1	0
Silicone Grease	45	0
Silicone Sealant	5	0
Silicone Spray	4	0
Solder Flux (Kester)	6	0
Solvent (Zero Mist)	4	0
Solvent (Relay Kleen GCE)	5	0
Solvent, Cont Clnr	6	0
Solvent, Cont Clnr/Degreaser	2	0
Stati-Kill Spray	3	0
Tool Grip Compound	1	0
Trichlorotrifluoroethane	10	0
Varnish Oil	1	0
Water Contaminated with Fuel	2,200	0
Cleaner, Foam	1	0
Adhesive (Permabond)	1	0
Adhesive, Contact CMT (Weld)	1	0
Alcohol, Denatured	1	0
Alcohol, Isopropyl	2	0
Alcohol, Isopropyl	0	200
Corrosion Inhib	1	0
Degreaser	1	0
Filter Coat (RP)	1	0
Freon (Zero Mist)	1	0
Ink Cleaner (Toluene)	1	0
Lubricant (Drilube TF)	1	0
Oil, Capella	0	4
Oil, Capella	5	0
Oil, Lube	0	5
Oil, Lube	5	0
Oil, Lube	25	0

TABLE B-1 (Continued)

Product	Waste Quantity	
	Solid (lb/yr)	Liquid (gal/yr)
Oil, Lube (Liquid Wrench)	1	0
Oil, Lube (WD-40)	5	0
Paint	1	0
Paint, Enamel	1	0
Paint, Primer	1	0
Rags, Oil	25	0
Solvent (Relay Kleen GCE)	3	0
Solvent, Head Cleaner	1	0
Trichlorotrifluoroethane	1	0

TABLE B-2

EXISTING HAZARDOUS WASTE PRODUCTS
GENERATED AT SLC-4E (BLDGS 715 AND 725)
FOR TITAN 34D PROGRAM

Bldg	Product	Waste Quantity	
		Solid (lb/yr)	Liquid (gal/yr)
715	1.1.1 Trichloroethane	1.00	0
715	1.1.1 Trichloroethane	50.00	0
715	Adhesive	2.50	0
715	Adhesive (APR Wetting Agent 2)	5.00	0
715	Adhesive (Eastman 910)	0.10	0
715	Adhesive (Loctite)	1.00	0
715	Adhesive, Contact CMT (Weld)	7.20	0
715	Alcohol, Denatured	25.00	25
715	Alcohol, Isopropyl	1.00	0
715	Alcohol, Isopropyl	0.00	27
715	Alcohol, Methyl	0.00	188
715	Alcohol, Methyl	2.00	0
715	Aliphatic/IPA	0.35	0
715	Bleach	0.00	1,100
715	Bleach	1,000.00	0
715	Burndy Penetrox A	0.00	0
715	Cannister Mask Cartridge	1,200.00	0
715	CC-330	50.00	0
715	Chico A5	7.00	0
715	Cleaner (General Foam)	1.44	0
715	Cleaning Fluid	272.00	0
715	Corrosion Inhib	13.00	0
715	Corrosion Inhib	78.00	0
715	Dashpot Fluid	0.20	0
715	Dearborn 537	0.00	165
715	Degreaser	11.50	0
715	Deluge Water	0.00	150,000
715	Desicant	0.50	0
715	Desicant	332.00	7
715	Duct Sealer	3.00	0
715	Dyes (Dykem)	0.35	0
715	Dynatherm	6.00	0
715	Electrolube	0.10	0
715	Ethylene Glycol, Antifreeze	0.00	55
715	Ethylene Glycol, Antifreeze	70.00	0
715	Filter Coat	1.44	0
715	Fluorosilicone Oil	0.50	0
715	Freon	30.00	0
715	Freon	13.70	0
715	Freon TF	0.50	0
715	Fuel Detox	200.00	200
715	Fuel Post-rinse	200.00	200
715	Fuel Pre-rinse	200.00	200

TABLE B-2 (Continued)

Bldg	Product	Waste Quantity Solid (lb/yr)	Waste Quantity Liquid (gal/yr)
715	Grease	2.00	0
715	Grease (Molykote)	15.00	0
715	Grease, Petroleum Base	15.00	0
715	Hydrazine	38.00	0
715	Hydrazine UDMH	0.00	1
715	Hydroxyacetic Acid	0.00	137
715	Hydroxyacetic Acid	1,250.00	0
715	Iridite	50.00	0
715	Lubricant	2.30	0
715	Lubricant	0.00	150
715	Lubricant	370.80	0
715	Lubricant (Drilube)	0.75	0
715	Lubricant, (Drilube)	6.50	0
715	Lubricant (Drilube TF)	9.40	0
715	Lubricant (LPS)	2.60	0
715	Lubricant, Antiseize	3.50	0
715	Martyte	1,469.00	0
715	Methyl Ethyl Ketone	25.00	7
715	Microbiocide H-430	20.00	0
715	N_2O_2 (Rocket Propellant)	0.00	0
715	Nitric Acid	0.00	1
715	Oil, Auto Transmission	6.00	6
715	Oil, Brake System	4.00	0
715	Oil, Capella	0.00	71
715	Oil, Capella	20.00	0
715	Oil, Cutting	5.00	0
715	Oil, Immersion	1.00	1
715	Oil, Gage	0.40	0
715	Oil, Hydraulic	0.00	30
715	Oil, Hydraulic	30.00	0
715	Oil, Hydraulic	348.00	100
715	Oil, Low Temp	0.30	0
715	Oil, Lube	4.00	0
715	Oil, Lube	3.20	0
715	Oil, Lube	125.00	0
715	Oil, Lube	50.00	2
715	Oil, Lube (Break Free)	1.00	0
715	Oil, Lube (WD-40)	5.20	0
715	Oil, Lube, Penetr, VP-30	1.00	0
715	Oil, Vacuum Pump	0.00	5
715	Oil, Vacuum Pump	5.00	0
715	Ospho	50.00	0
715	Oxidizer Detox	0.00	200
715	Oxidizer Detox	200.00	0
715	Oxidizer Post-rinse Detox	200.00	0
715	Oxidizer Post-rinse Detox	0.00	200
715	Oxidizer Pre-rinse Detox	0.00	200

TABLE B-2 (Continued)

Bldg	Product	Waste Quantity Solid (lb/yr)	Waste Quantity Liquid (gal/yr)
715	Oxidizer Pre-rinse Detox	200.00	0
715	Paint	83.60	0
715	Paint, Enamel	84.00	0
715	Paint, Primer	13.32	0
715	Paint, Primer	35.00	0
715	Paint, Stripper	100.00	0
715	Paint, Thinner	600.00	0
715	Pasajell	6.00	0
715	Permatex	0.24	0
715	Rags	25.00	0
715	Rags	100.00	0
715	Rags	5.00	0
715	Rags	25.00	0
715	Rags	50.00	0
715	Rags	5.00	0
715	Rags, Iridite	25.00	0
715	Rags, Oil	25.00	0
715	Rags, Solvent	15.00	0
715	RC 380 Water Treatment	0.00	110
715	RC 380 Water Treatment	30.00	0
715	Rubber Cement	1.10	0
715	Rust Remover	1.40	0
715	Sealant	3.50	0
715	Sealant (Loctite)	1.50	0
715	Silicone (Dow Corning 111)	1.20	0
715	Silicone Grease	45.00	0
715	Silicone Sealant	5.00	0
715	Silicone Spray	3.70	0
715	Solder Flux (Kester)	5.50	0
715	Solvent (Relay Kleen GCE)	5.20	0
715	Solvent (Zero Mist)	3.60	0
715	Solvent, Cont Clnr	6.20	0
715	Solvent, Cont Clnr/Degreaser	1.60	0
715	Stati-Kill Spray	3.20	0
715	Tool Grip Compound	1.40	0
715	Trichlorotrifluoroethane	10.00	0
715	Varnish Oil	0.375	0
715	Water Contaminated with Fuel	0.00	2,200
725	Cleaner, Foam	0.60	0

TABLE B-3

HAZARDOUS WASTE PRODUCTS GENERATED
AT BLDG 945 FOR TITAN IV PROGRAM

Product
Paint, Chemray yellow enamel
Lube oil, refrig. compress.
Paint thinner
Potassium hydroxide
Adhesive, carboline
Odor counteractant
Brake Fluid
Methyl Isobutyl Ketone
Spray, Slipicone
Contact re-nu, MS-230
Cork compound
Dichloromethane
Electrical contact cleaner
Freon TF
Freon TF Solvent
Hydraulic Fluid
Isopropyl alcohol
Leak detection solution
Polyurethane coating
Starting Fluid
Thread compound MIL-T-5544
Trichloroethane AM-3
Universal Oil 30
Vinyl coating
Toner Pre-mix
Toner Versatec
Epon 934-Hysol
Aircraft grease
Red Primer Coat
RIV 732
Zyglo
Silicone rubber

NOTE: Existing and projected quantities at Bldg 945 are not available.

TABLE B-4

HAZARDOUS WASTE PRODUCTS TO BE GENERATED AT BLDG 8337 FOR TITAN II AND TITAN IV PROGRAMS

Product (Manufacturer)	Waste Quantity	
	Solid (lb/yr)	Liquid (gal/yr)
Methyl Ethyl Ketone	0	10
Silver Fill/Coating (Plessey)	100	0
Thermal Coating (Plessey)	500	0
Silicone Adhesive (General Electric) (W/Curing Agent)	200	0
Trichlorotrifluoroethane	0	200
Silicone Insulation Coating	750	0
Treating Agent (PAZ) (Flamemaster)	50	0
Dispersion Coating (SWS Silicon Corp)	20	0
White Silicone Paste (Ferro Corp)	5	0
Black Pigment Dispersion (Ferro Corp)	5	0
Silicone Paste (Ferro Corp)	10	0
Iridite 14-2	200	1
Marvel Guard Thread Lubricant	1	0
Leak Test Compound Type CG	1	0
Lubricant (Fluoro-Glide)	1	0
Primer (Clear)	100	0
Spray-Lub Fluorocarbon	2	0
Mineral Spirits	5	1

TABLE B-5

EXISTING AND ADDITIONAL HAZARDOUS WASTE
PRODUCTS GENERATED AT BLDG 8401 FOR TITAN II
AND TITAN IV PROGRAMS

Product	Waste Quantity Solid (lb/yr)	Waste Quantity Liquid (gal/yr)
Existing Support Functions:		
Adhesive	0.0	1
Adhesive (3M)	0.0	1
Adhesive (Aliphatic Resin)	0.0	3
Adhesive (Butyl)	0.0	1
Adhesive (Rubber)	0.0	1
Cleaner (Gabriel Vandal)	1.44	0
Cleaner (Sno-White)	1.2	0
Cleaner (Xerox Formula A)	12.0	0
Cleaner, All Purpose	1.25	50
Cleaner, Carpet	2.0	0
Cleaner, Chrome (AB Dick)	3.0	0
Cleaner, Degreaser	25.0	25
Cleaner, Glass	100.0	33
Cleaner, Heavy Duty	4.5	0
Cleaner, Lens and Plate (Xerox)	6.0	0
Cleaner, Plate (AB Dick)	0.25	0
Cleaner, Tray (NACCO)	1.0	1
Conditioner (AB Dick)	6.0	0
Contaminated Water	0.0	940
Deglazer	200.0	0
Detergent	150.0	150
Developer (3M)	0.72	0
Developer (AB Dick)	1.0	0
Developer (Xerox)	120.0	0
Developer (Naccolith)	50.0	208
Disinfectant (End Bac II)	0.12	0
Drano	24.0	24
Electrofilm	1.0	0
Electrostatic Conversion	144.0	0
Film Remover (Xerox)	6.0	0
Filter Coat Research	2.16	0
Fixer Bath (Kodak)	3.0	0
Floor Finish (Resist 20)	150.0	24
Floor Sealer (Aqua Tone II)	5.0	0
Floor Stripper (No Rinse Half)	50.0	50
Floor Stripper (SSS Seal)	60.0	500
Floor Stripper (Zip Strip)	50.0	75
Flux Remover Solvent MS	0.4	0
Fountain Concentrate (AB Dick)	10.0	0
Freezing Compound (H.O. Stores)	0.3	0
Fuser Agent (Xerox)	18.0	0
Fuser Lubricant (Xerox 1090)	0.4	0

TABLE B-5 (Continued)

Product	Waste Quantity Solid (lb/yr)	Liquid (gal/yr)
Fuser Oil (Xerox)	6.0	0
Glayzit, MCCI	0.2	0
Grease	5.0	0
Hartner Film (Nacco)	12.0	24
Herbicide (Ortho Triox)	1.0	0
Hydometer	0.5	0
Impression Kit	0.1	0
Ink	93.6	0
Ink (Rubber Based)	12.0	0
Ink (Stencil)	0.12	0
Ink (Xerox)	6.0	0
Insecticide	24.0	0
Insecticide (Formula K-5)	1.0	0
Insecticide (Raid)	0.05	0
Iridite (14-2 A1-Coat)	1.0	0
Lubricant (Drilube)	0.0	1
Lubricant (Dupont, Dry)	0.1	0
Monoborchlorate	10.0	0
Offset Dispersant (AB Dick)	90.0	104
Offset Etch (AB Dick)	60.0	0
Offset Toner Solution (AB Dick)	90.0	104
Oil Finish, Antique	2.0	0
Oil, 30W, Lube	6.0	0
Oil, 30W, Lube (Havoline)	0.5	0
Oil, Lube (Liquid wrench)	1.45	0
Oil, Lube (WD-40)	2.74	0
Oil, Lube, Penetr	0.5	0
Oil, Lube (LP 30)	0.5	0
Oil, Vacuum Pump (Kinney)	2.0	0
OMNI Etch #3 (Grove Fountain)	1.0	6
Paint, Enamel	0.0	3
Paint, Epoxy	0.0	3
Paint, Primer	0.0	2
Paint, Primer, Zinc Chromate	1.0	0
Paint, Stripper	25.0	0
Paint, Thinner (Brolite)	8.0	0
Plytech Etch	25.0	25
Process Gum	12.0	0
Rags, Solvent	200.0	0
Solvent (Blankrola)	50.0	520
Solvent (Relay Kleen GCE)	0.2	0
Solvent Cont Clnr	0.6	0
Solvent Head Cleaner	1.44	0
Spent Dry Batteries	6.1	0
Stain, Oil Base	2.0	0
Static Arrestor	2.88	0

TABLE B-5 (Continued)

Product	Waste Quantity Solid (lb/yr)	Waste Quantity Liquid (gal/yr)
Core Vehicle Asssembly Bldg portion:		
Hydraulic Fluid	100.0	100
1.1.1-Trichloroethane	20.0	10
Methyl Ethyl Ketone	0.0	5
Freon 113	0.0	10
IPA	20.0	50
Fel-Pro C5 Grease	10.0	0
Loctite Grease	1.0	0
Silicone Lubricant	5.0	0
Potting Material	5.0	0
Primer	50.0	0

TABLE B-6

EXISTING AND ADDITIONAL HAZARDOUS WASTE
PRODUCTS GENERATED AT BLDG 9325 FOR TITAN II
AND TITAN IV PROGRAMS

Product	Existing Waste Quantity		Additional Waste Quantity	
	Solid (lb/yr)	Liquid (gal/yr)	Solid (lb/yr)	Liquid (gal/yr)
1.1.1 Trichloroethane	6	6	3	3
1.1.1 Trichloroethane	2	0	1	0
Adhesive	0.5	20	0.25	10
Adhesive (Acrylic Cement)	0.2	0	0.12	0
Adhesive (Aliphatic Resin)	0.0	6	0.0	0
Adhesive (Armstrong Type 520)	0.2	0	0.12	0
Adhesive (Dry Wall)	250	0	124	0
Adhesive (Filter Coat)	0.4	0	0.25	0
Adhesive (Floor Covering)	40	0	20	0
Adhesive (Goodyear)	1.5	0	0.75	0
Adhesive (Scotch)	0.0	0	1.44	0
Adhesive (Weld-on Plastic)	0.2	0	0.12	0
Adhesive (Weld-on Wood)	0.0	0	1.0	0
Adhesive AP21B	1	0	0.5	0
Adhesive CID-A-A-529	2	0	1.0	0
Adhesive, Cont Cement (Dioptac)	0.1	0	.05	0
Adhesive, Epoxy	0.1	0	.05	0
Adhesive, Multi-Purpose Cement	7	0	3.5	0
Adhesive/Sealant RTV 732	0.1	0	.05	0
Alcohol, Denatured	2	0	1	0
Alcohol, Methyl	2	0	1	0
Ammonia, Aqueous	2	2	1	1
Ammonium Bisulfide Flakes	60	0	30	30
Bead Blast Material	1200	0	600	0
Blitz	0.0	0	5.5	0
Brushes, Solvent/Paint	100	0	50	0
Caulk (DAP)	4	0	2	0
Caulk (BE)	4	0	2	0
Cee-Bee A202	1	1	1	1
Cement, Instant	10	0	5	0
Chromium Trioxide	12	0	6	0
Chromium Trioxide	12	0	6	0
Circuit Cooler	0.2	0	0.12	0
Cleaner, Glass	66	0	0.05	0
Cleaner, Ice Machine	2	2	1	1
Cleaner, Metal	2	0	1	0
Cleaner, Pen (Rapido-Eze)	0.1	0	0.05	0
Cleaner, Pine Oil	0.0	0	2	0
Cleaner, Plastic (Permatex)	0.2	0	0.12	0
Cleaning Solution, Engraver	0.2	0	0.07	0
Coatalyte, Bright Nickel	0.1	0	0.05	0
Coatalyte, Rhodium	0.1	0	0.05	0

TABLE B-6 (Continued)

Product	Existing Waste Quantity Solid (lb/yr)	Existing Waste Quantity Liquid (gal/yr)	Additional Waste Quantity Solid (lb/yr)	Additional Waste Quantity Liquid (gal/yr)
Contaminated Water	0.0	2000	0.0	940
Corrosion Inhib	0.0	300	1	0
Corrosion Inhib	10	0	1	0
Dashpot Fluid, Blue	0.1	0	0.05	0
Datakoat, Coat and Thinner	0.1	0	0.05	0
Degreaser (Krylon)	1.5	0	0.72	0
Deoxidizer (ARP 11)	2	2	1	1
Detergent (ARP 44)	150	150	1	10
Developer D-70	2	2	1	1
Disinfectant, Gas Mask	0.2	0	0.25	0.25
Duct Sealer (United)	2	0	1	0
Dyes, Layout (Dykem)	2.5	0	1.2	0
Dyes, Wetting Agent (ARP 2)	0.0	10	0.0	5
Electrofilm	2	2	1	1
Electrolyte, Battery, KOH	0.0	0.5	0.0	0.25
Electrolyte, Battery, KOH	0.0	0.5	0.0	0.25
Epoxy (Mobil Zinc 4)	6	0	2.8	0
Epoxy Grout (Por-Rok)	6	0	3.1	0
Epoxy Potting	2	0	1	0
Erasing Fluid (K & E)	0.1	0	0.05	0
Fiberglass Resin	2	0	1	0
Fiberglass Resin	2	0	1	0
Freon	200	0	101	100
Freon 113	2	0	1	5
Freon TF	25	0	25	25
Grease	20	0	0.0	0
Ink (Acid)	01	0	0.06	0
Ink (Stamping)	01	0	0.05	0
Ink (Stencil)	0.2	0	0.12	0
Insecticide	2	0	1.2	0
Insecticide (Stati-Kil)	0.7	0	0.36	0
Iridite 14-2 Al-Coat	10	2	1	1
Iridite 14-2 Chromate Film	10	0	5	0
Lubricant (DC1265)	0.1	0	0.04	0
Lubricant (DC 5S)	0.1	0	0.05	0
Lubricant (DC)	0.1	0	0.05	0
Lubricant (Drilube)	0.5	0	0.25	0
Lubricant (Dupont, Dry)	2	0	0.1	0
Lubricant (Lube-Lok 2109)	2	0	1	1
Lubricant (Lubriplate)	0.2	0	0.12	0
Lubricant (Molykote)	1.5	0	0.65	0
Lubricant (Drilube)	0.2	0	0.1	0
Lubricant (Electrofilm)	2	0	1	0
Manometer Fluid	0.2	0	0.12	0
Methyl Ethyl Ketone	20	20	10	10
Naphtha	0.5	0.5	0.25	0.3

TABLE B-6 (Continued)

Product	Existing Waste Quantity Solid (lb/yr)	Existing Waste Quantity Liquid (gal/yr)	Additional Waste Quantity Solid (lb/yr)	Additional Waste Quantity Liquid (gal/yr)
Nitric Acid	30	25	15.3	13.3
Oakite 33 (Phosphoric Acid)	300	100	155	55
Oil, Brake System	2	2	1	1
Oil, Duo Seal Pump	2	2	1	1
Oil, Dust Mop	10	0	5	0
Oil, Gear	2	2	1	1
Oil, Hydraulic	30	30	15	16
Oil, Lube	2	2	1.29	1.25
Oil, Lube	2	2	1.29	1.25
Oil, Lube (WD-40)	7	0	3.6	0
Oil, Lube, Penetr	1	0	0.5	0
Oil, Lube, Penetr (VP-30)	1	0	0.5	0
Oil, Refrigerant (Sunisco)	2	2	1	1
Oil, Vacuum Pump	2	2	1	1
OSPHO	10	10	5	5
Oxidation Remover (OSPHO)	10	10	5	5
Oxide Cleaner	2	2	1	1
Paint	0.0	10	0.0	6
Paint, Acrylic	.5	15	2.5	8
Paint, Antiskid	10	0	5	0
Paint, Assorted	4	0	2	0
Paint, Enamel	25	0	11.25	0
Paint, Enamel	10	0	0.0	0
Paint, Enamel Reducer	10	0	5	0
Paint, Lacquer	60	0	32	0
Paint, Lacquer Thinner	2	2	1	1
Paint, Latex	20	0	8	0
Paint, Liquid Dryer	0.5	1	0.25	0.5
Paint, Oil Base	20	0	8	0
Paint, Oil Finish	1	0	0.25	0
Paint, Polyurethane	2	0	1.12	0
Paint, Primer	15	0	6.25	0
Paint, Primer (Dow Type 2)	2	0	1	0
Paint, Primer Zinc Chromate	5	0	1.25	0
Paint, Roofing	10	0	5	0
Paint, Thinner (Brolite)	10	25	8	8
Paint, Thinner (Carboline)	10	10	5	5
Paint, Thinner (Cordurite)	6	6	3	3
Paint, Thinner (Koppers)	6	6	3	3
Paint, Thinner (MACLAC)	6	6	3	3
Paint, Thinner (Mobil)	6	6	3	3
Paint, Thinner (Porter)	6	6	3	3
Paint, Thinner	10	10	5	5
Paint, Varnish	2	0	1	0
Pasajell	0.5	0.5	0.25	0.25
Peel-Off (Turco)	10	6	5	3

TABLE B-6 (Continued)

Product	Existing Waste Quantity Solid (lb/yr)	Existing Waste Quantity Liquid (gal/yr)	Additional Waste Quantity Solid (lb/yr)	Additional Waste Quantity Liquid (gal/yr)
Penetrant (Met Flaw Finder)	6	0	3	0
Phosphoric Acid	10	10	5	5
Plastic Putti	1	0	0.5	0
Rags	400	0	200	0
RTV, Silastic 732	1	0	0.6	0
Sealant, Concrete	20	0	10	0
Silicone Spray	0.5	0	0.05	0
Sodium Chromate	2	2	1	1
Sodium Hydroxide	10	0	5	0
Solder Flux	0.2	0	0.12	0
Solvent, Carbon Clnr (Cee-Bee)	10	10	5	5
Solvent, Cont Clnr	1	0	0.24	0
Spra Kleen	1	0	0.0	0
Stain (Oil Base)	2	0	0.0	0
Stati Kill Spray	1	0	0.0	0
Toluene-Toluol	10	10	5	5
Tool Grip Compound	0.0	0	0.0	0
Turco-4215	40	0	20	0
Turco-4409	2	2	1	1
Turpentine	2	2	1	1
Varnish and Stain Remover	2	0	0.0	0
Varnish, Urethane	2	0	0.0	0
Water Displacer	0.0	0	17.28	0

APPENDIX C

ARCHAEOLOGICAL SURVEY REPORT FOR CONSTRUCTION OF TITAN IV SPACE LAUNCH VEHICLE PROGRAM FACILITIES AT VANDENBERG AIR FORCE BASE CALIFORNIA

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APPENDIX C

ARCHAEOLOGICAL SURVEY REPORT FOR CONSTRUCTION OF TITAN IV SPACE LAUNCH VEHICLE PROGRAM FACILITIES AT SPACE LAUNCH COMPLEX 4-EAST AT VANDENBERG AIR FORCE BASE SANTA BARBARA COUNTY CALIFORNIA

ABSTRACT

Archival research and an archaeological survey were conducted on nine parcels of land on South Vandenberg Air Force Base. The objective of this study was to locate, identify, and assess any historical and prehistoric cultural resources which might be affected by construction associated with the Titan Program at Space Launch Complex 4-East. It was determined from the field investigation and records search that no historic or prehistoric cultural resources would be affected by the proposed activities.

INTRODUCTION

Project Description and Location

In support of the Department of Defense space program, the United States Air Force (USAF), Headquarters Space Division proposes to modify Space Launch Complex 4 East (SLC-4E) and associated support facilities at Vandenberg Air Force Base (VAFB), California, for processing and launch of Titan IV space vehicles.

The proposed project consists of modification, construction, and use of facilities on Vandenberg Air Force Base, Santa Barbara County, California. The following areas of new construction are the subject of this report:

1. New Mobile Service Tower (MST) Air Conditioning Facility at SLC-4E
2. Borrow/Spoil Area at SLC-4E
3. Stairway from Fuel Trailer Pad to the Fuel Holding Area at SLC-4E

4. Intersection of the existing security road to the propane trailer pad, addition of fuel vapor incinerator pad, addition of payload oxidizer trailer pad, addition of payload fuel trailer and waste trailer loading pad (all within SLC-4E)

5. Improvement of an existing road to be used for a haul road from Dix Road to the Launch and Service Building at SLC-4E

6. Increasing Fallback Area 17 by one acre to the south of the existing area

7. Reworking of existing road shoulders on Dix Road, Old Surf Road, and Coast Road from the proposed haul road (5 above) to the prefabrication area

8. Burial in place of four existing electrical power lines in the SLC-4 area

9. Parking and office areas northwest of Building 945 (existing RIS Facility)

Environmental Setting

VAFB is located on the coast in the northwestern portion of Santa Barbara County. The SLC-4 project area is located approximately 7 km south of the mouth of the Santa Ynez River. The area is composed of uplifted eroded remnants of Lompoc Mesa, a Quaternary coastal headland which faces in a west/northwesterly direction and is exposed to the prevailing winds and ocean waves of the region. Topography consists of a number of ancient, wave-cut terraces covered by a thin aeolian sheet, consisting of sand dune deposits of various ages (Harmsworth, 1987a).

Local Prehistory

This project area is within the territory historically occupied by the Purisimeno group of the Chumash speaking peoples of California. Archaeological evidence has revealed that the predecessors of the Purisimeno settled in Santa Barbara County more than 8000 years ago (Glassow and Spanne, 1976; Greenwood, 1972). Following an annual cycle of hunting, fishing, and gathering, the Chumash peoples adapted to changing environmental and social conditions and evolved into a large complex society (Harmsworth, 1987b). Aboriginal society began to disintegrate soon after Spanish contact in A.D. 1769, primarily due to the introduction of epidemic European diseases and the subsequent high mortality rate.

SURVEY METHODS AND RESULTS

Survey Methods

An archaeological record search was conducted for the project area at the Central Coastal Information Center at University of California, Santa Barbara and at the office of the VAFB Base Archaeologist.

It was determined that there were no previously recorded sites within the project areas (PA), although several were in the vicinity. Table C-1 summarizes the archaeological sites near the project areas.

TABLE C-1

ARCHAEOLOGICAL SITES IN THE
VICINITY OF THE PROJECT AREAS

Project Area	Archaeological Site Number
1	CA-SBA-537
2	CA-SBA-537, CA-SBA-1816
3	CA-SBA-537, CA-SBA-1816
4	CA-SBA-537, CA-SBA-1816
5	CA-SBA-537
6	CA-SBA-680
7	CA-SBA-1940
8	CA-SBA-1940
9	Isolates

Several of these sites are in close proximity to the proposed construction areas. Project Area 6 is south of CA-SBA-680; Project Area 7 is south of CA-SBA-1940; and two isolated archaeological occurrences are near the proposed construction area at Building 945 (PA 9). Archaeological testing has been conducted in the area of Building 945 and associated facilities with negative results (Pergler, 1987; Centeno, 1987).

A number of prior cultural resource surveys and investigations have been conducted that include these proposed construction areas. Four studies are considered to be the most pertinent for this research:

1. The Space Transportation System (STS) project included a survey of a 3,000 foot wide corridor (Glassow and Spanne, 1976) which overlapped several of the project areas (portions of PA 5, 6, 7, 8, and 9);

2. The Natural Gas Pipeline Project (USAF, 1987), which included survey and excavation, encompassed several of the project areas within this investigation (portions of 5, 6, 7, and 8);

3. The SLC-4 Repair and Restoration Program (Harmsworth 1987a) included seven of the nine proposed construction areas for the Titan IV project (PA 1, 2, 3, 4, portions of 5, portions of 7, and 8)

4. The SLC-4 Repair and Restoration Program Draft Treatment Program (Harmsworth, 1987b).

Each of these studies was comprehensive in regard to cultural resources and in combination, they covered all of the project areas and archaeological sites included in this investigation. In addition, one of these prior projects is developing a Treatment Program for archaeological sites CA-SBA-537 and CA-SBA-1816 which are in the vicinity of PA 1, 2, 3, 4, and 8 (Harmsworth, 1987b).

The four archaeological sites (CA-SBA-537, -680, -1816, and -1940) in the vicinity of the proposed construction areas are summarized below:

(1) Archaeological Site CA-SBA-537

Description

This site is an oval shaped, 180 x 700 m, food and processing site. The west end of th site is still undefined due to modern and intermediate sand dunes which extend to the modern coast.

Assessments and Previous Impacts

Previous impacts to the site consist of several roads through the area, excavation of erosion control terraces cut into the canyon slopes below SLC-4W, and dumping of concrete in a 55 m diameter area just west of the SLC-4W complex. It is estimated that the eastern 400 m of the site, along the canyon rim, has been buried or destroyed by the construction of the SLC-4W complex, leaving roughly half of the site intact.

Current Status

As part of the SLC-4 Repair and Restoration project, additional impacts are predicted: cutting into site for line of site view for fence, development of construction haul road and access roads, trenching for emplacement of a retaining wall, and removal of concrete rubble that lies on the site. In conjunction with the security fence project, CA-SBA-537 was archaeologically tested and found to qualify for listing on the National Register of Historic Places (NRHP). A data recovery program has been proposed to achieve a no adverse effect determination. Although five of the Project Areas (PA 1, 2, 3, 4 and 5) associated with the Titan IV Program are in the vicinity of CA-SBA-537, none will affect it.

(2) Archaeological Site CA-SBA-680

Description

This site is described as a lithic workshop and temporary camp. It is located on the southern rim of Bear Creek Canyon and is estimated to be 112,455 m^2 in size.

Assessments and Previous Impacts

The site has been wind damaged with several aeolian cut and fill episodes. There have been three previous archaeological investigations at this site (STS Towroute, a 69 kV Transmission line, and the Natural

Gas Pipeline Project). Each of these projects resulted in limited data recovery programs.

Current Status

CA-SBA-680 was previously determined to be eligible for the NRHP. The Natural Gas Pipeline Project was realigned to avoid the site. This site is located immediately north of Fallback Area 17. Project Area 6 of the Titan IV Program, which will expand the Fallback Area to the south will not affect this archaeological site.

(3) Archaeological Site CA-SBA-1816

Description

This site is described as a prehistoric habitation site consisting of two loci separated by a sparse shell midden. The site is located to the east of CA-SBA-537.

Assessments and Previous Impacts

Previous impacts to the site consist of access roads through the loci and the placement of fill over Locus B. As part of the SLC-4 Repair and Restoration Project, it is proposed that a short haul road be cut through the site and that the site be covered by fill. It is possible that the weight of the road fill may cause breakage and compaction of the shell middens. In addition, covering the site with fill will remove it from the archaeological research base.

Current Status

To offset these predicted effects a data recovery program is planned. Archaeological testing of the site has led to the determination that the site is eligible for the NRHP. Project Areas 2, 3, and 4 of the Titan IV Program are near CA-SBA-1816, but are not close enough nor is the proposed undertaking of the nature that would affect this resource.

(4) Archaeological Site CA-SBA-1940

Description

This site is a lithic production site situated to the north of the SLC-4E complex. The site is oval in plan and is 30 x 50 m in size.

Assessments and Previous Impacts

Previous impacts to the site consist of a 20 x 30 m natural blowout in the center of the resource, emplacement of communication cables and road construction. As part of the SLC-4 Repair and Restoration Project, CA-SBA-1940 was tested, due to the presence of two isolated artifacts located within the proposed security fence impact zone. Testing between the fence and observed boundaries of the site were negative for cultural resources.

Current Status

As a result of the testing for the SLC-4 Repair and Restoration Project, the site was found to be potentially eligible for the NRHP. CA-SBA-1940 is located immediately north of the existing haul road to be used by the Titan IV Program, where it turns south to the SLC-4E complex. The proposed modification to the haul road will realign it away from the site. Consequently further testing of the site is not considered appropriate, in lieu of the negative findings for the SLC-4 Repair and Restoration Project in the same area. However, Project Areas 7 and 8 of the Titan IV Program are sufficiently close to this site to warrant monitoring during project construction.

Titan IV - Specific Survey

On November 9, 1987, John M. Foster, archaeologist, of Greenwood and Associates, Joanne Sanfilippo, archaeologist, Juanita Centeno, Native American Observer, and Chuck Pergler, Martin Marietta Corporation, conducted an archaeological field survey of several of the proposed construction areas, (portions of PA 5, 7, 8, and 9). Only four of the nine project areas, those in close vicinity to recorded archaeological sites, were resurveyed since the three prior investigations are considered to be adequate for the remaining proposed construction areas.

Survey procedures entailed walking transects at 15-meter intervals, enabling a 100% ground surface investigation for cultural resources in the project area.

All cultural features were plotted on a base map. Disturbance within the project area consisted of existing facilities, eroding gullys, dirt roads, bulldozer trails, and sheet wash.

Survey Results

No cultural resources were found in the proposed areas of construction, although, as noted above, the proposed new haul road (PA 5) along Dix Road is in close proximity to CA-SBA-1940. The confidence in the survey is considered high, due to intermittent but good ground visibility, redundant prior surveys, and erosion cuts which revealed subsurface attributes.

Recommendations

It is found that the construction plans for the proposed facilities will have no effect on significant cultural resources. This does not preclude the possibility that archaeological deposits may exist below the existing grade and could be encountered during land alterations associated with the proposed projects. Since the proposed haul road (PA 5) is in close proximity to CA-SBA-1940, it is recommended that an archaeologist and Native American Observer monitor this area during grading operations.

In the event that archaeological remains are discovered during subsurface construction, land alteration work shall be halted and redirected and the State Historic Preservation Officer shall be consulted.

REFERENCES CITED

Centeno, Juanita, 1987, Personal communication to John Foster.

Glassow, Michael A., and Laurence W. Spanne, 1976, Evaluation of Archaeological Sites on Vandenberg Air Force Base, Santa Barbara County, California. Final Report. Ms. on file, Department of Anthropology, University of California, Santa Barbara.

Greenwood, Roberta S., 1972, 9000 Years of Prehistory at Diablo Canyon, San Luis Obispo County, California. San Luis Obispo County Archaeological Society Occasion Paper No. 7.

Harmsworth Associates, 1987a, Documentation in Support of U.S. Air Force No Adverse Effect Determination, Security Fence Construction Project, Space Launch Complex 4 Reactivation, Vandenberg Air Force Base. Harmsworth Associates. Submitted to USAF, Vandenberg Air Force Base.

Harmsworth Associates, 1987b, A Draft Treatment Program for Historic Properties Affected by the Space Launch Complex 4 Restoration Program, Vandenberg Air Force Base, Santa Barbara County, California. Harmsworth Associates. Ms. on file, Vandenberg Air Force Base.

Pergler, Chuck, 1987, Personal communication to John Foster.

United States Air Force, 1987, Documentation in Support of U.S. Air Force No Adverse Effect Determination and Evaluations of National Register Eligibility Status for Affected Historic Properties. On file, Vandenberg Air Force Base.